Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
International Comparison Requirements Pursuant	)	IB Docket No. 10-171
to the Broadband Data Improvement Act	)	GN Docket 11-121
	)	
International Broadband Data Report	)	

THIRD REPORT

Adopted: August 13, 2012 **Released: August 21, 2012**

By the Chief, International Bureau:

I. INTRODUCTION

1. This is the Commission's third annual *International Broadband Data Report* (*IBDR* or Report). The *IBDR* is required by the Broadband Data Improvement Act (BDIA) and provides comparative international information on broadband services.[1] Through the presentation of this data, we have the opportunity to evaluate the United States' rates of broadband adoption, speeds, and prices in comparison to the international community. International data can serve as useful benchmarks for progress in fixed and mobile broadband accessibility.

2. In the past year, both fixed and mobile broadband providers have made significant progress in their efforts to expand broadband networks and improve service quality. As noted in the *Eighth 706 Report* released today, the market is responding to the needs of Americans for increased broadband capabilities.[2] In 2011, U.S. investment in wired and wireless network infrastructure rose 24%.[3] Some recent trends show that providers are offering higher speeds, more data under their usage limits, and more advanced technology in both fixed and mobile broadband. For example, cable operators have increased their deployment of DOCSIS 3.0-based data networks, which are capable of providing 100 megabits per second or faster (Mbps) speeds. In the last three years, the percentage of households passed by DOCSIS 3.0 broadband infrastructure has risen from 20% to 82%.[4] Advances in broadband technology and initiatives to promote greater deployment and adoption of broadband services have led to broadband-enabled innovation in other fields such as health care, education, and energy efficiency. Consumers all over the world are using applications and services created by U.S. companies, including social networks, search engines, and e-commerce. Although the OECD (Organization for Economic Co-operation and Development) has not updated its cable modem coverage data since 2008, it ranked the United States first

[1] *See* 47 U.S.C. § 1303(b). In this report we use the term "broadband" synonymously with "advanced telecommunications capability." *See generally Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications of 1996, as Amended by the Broadband Data Improvement Act*, GN Docket No. 11-121, Eighth Broadband Progress Report, FCC 12-90 (2012) (*Eighth 706 Report*).

[2] *Eighth 706 Report*, at ¶ 6.

[3] TELECOMMUNICATIONS INDUSTRY ASSOCIATION, TIA'S 2012 ICT MARKET REVIEW AND FORECAST 1-3 (2012).

[4] NCTA, Industry Data, http://www.ncta.com/Statistics.aspx.

out of 28 countries in cable modem coverage, and we have no reason to think that this ranking has changed.[5]

3. Wireless providers are deploying new, faster, and more spectrally-efficient technologies for mobile broadband, known as 4G LTE.[6] American consumers have been quick to adopt 4G LTE technology, securing the United States' position as the world leader in LTE adoption. In the 15th Annual Mobile Wireless Competition Report, the Commission observed that there were no commercial LTE launches in the United States as of August 2010.[7] By the end of 2011 though, U.S. LTE subscribers numbered 5.6 million, accounting for 64% of the roughly 9 million LTE subscribers worldwide.[8] Deloitte predicts that U.S. investment in 4G networks during 2012-2016 could be $25-$53 billion.[9] Aggressive LTE network build-out by U.S. providers has been a driving force in customer take-up and we anticipate that this trend will continue. Analysts anticipate that globally, LTE subscribership will reach at least 400 million by 2016.[10] We will continue to follow global LTE trends for future *IBDR*s.

4. With this progress, the United States has regained its role as a global leader in and around mobile broadband. More than 80% of smartphones sold globally run on U.S. operating systems, up from less than 25% three years ago.[11] As the first adopters of 4G LTE, the U.S. is the global test bed for wireless technology and services. In 2011, venture investment in Internet start-ups reached its highest

[5] OECD Broadband statistics, Table 3e, Availability of cable modem services (up to 2008), available at http://www.oecd.org/sti/broadbandandtelecom/44435586.xls. To compile this ranking, the data that the OECD uses for the United States is current as of the end of 2007. For other countries, the data is current as of as early as 2003 (Korea) and as late as 2008 (United Kingdom).

[6] *See, e.g.*, Press Release, *Verizon Wireless 4G LTE Network Will Be Available to More then 2/3 of U.S. Population Starting April 19*, Verizon Wireless (Apr. 17, 2012), http://news.verizonwireless.com/news/2012/04/pr2012-04-16c.html.

[7] Implementation *of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, WT Docket No. 10-133, Fifteenth Report, 26 FCC Rcd 9664, 9706, n. 115 (2011), *available at* .http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-103A1.pdf.

[8] US Remains at Forefront of LTE Service Adoption, TeleGeography (Mar. 15, 2012), *available at* http://www.telegeography.com/products/commsupdate/articles/2012/03/15/us-remains-at-forefront-of-lte-service-adoption/ (finding that the United States leads the world in 4G adoption).

[9] Deloitte, *The impact of 4G technology on commercial interaction, economic growth, and U.S. competitiveness* (Aug. 2011), *available at* http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/TMT_us_tmt/us_tmt_impactof4g_081911.pdf (noting that analysts predict investment in 4G wireless networks could amount to between $25 and $53 billion over the next four years, creating as much as $150 billion in GDP growth and up to 770,000 new jobs).

[10] Wireless Subscribers by Region, Telegeography Research, *available at* http://www.telegeography.com/products/globalcomms/world-and-regional-totals/wireless-subscribers-by-region/index.html (predicting 400 million LTE subscribers worldwide by 2016); Global 4G LTE Usage Expected to Skyrocket, PC Magazine (July 25, 2012), *available at* http://www.pcmag.com/article2/0,2817,2407612,00.asp (noting that Parks Associates predicts 560 million LTE subscribers worldwide by 2016); LTE Connections To Hit 90 Million By Year's End, 1 Billion By 2017, Techcrunch (May 17, 2012), *available at* http://techcrunch.com/2012/05/17/report-lte-connections-to-hit-90-million-by-years-end-1-billion-by-2017/.

[11] *Android, Apple Own 80% of Global Smartphone Market: Microsoft's Share, 2.2%*, PC World (May 24, 2012), *available at* http://www.pcworld.com/article/256155/android_apple_own_80_of_global_smartphone_market_microsofts_share_22.html.

levels since 2001.[12] The apps economy, a $20 billion industry that barely existed five years ago, has created nearly 500,000 jobs.[13]

5. The Commission has also adopted a number of major initiatives in the last year to help increase adoption rates by bringing down major barriers to adoption and utilization – access and affordability. Last year, the Commission released the *USF/ICC Transformation Order*, which establishes the Connect America Fund and transforms the existing high-cost universal service program in order to speed delivery of broadband to all Americans.[14] For the millions of Americans who do not have access to fixed broadband, implementation of this Order will mean access to the benefits of broadband, such as long-distance learning options, health information technology, and economic opportunities. For other Americans, access to broadband is limited by affordability, a lack of digital literacy, and a perception about the Internet's usefulness to them.[15] Earlier this year, the Commission also released a modernized Lifeline Order, adopting reforms to the Lifeline program, including the Broadband Pilot Program, which uses $25 million to increase broadband adoption among low-income Americans.[16] *Connect2Compete*, which was developed with the cooperation of the private industry last year, also aims to connect low-income families to low-cost computers, digital literacy training, and low-cost Internet service by targeting students eligible for free school lunch.[17]

6. The roll-out of DOCSIS 3.0 and LTE, the Commission's recent reforms targeting broadband availability and adoption, and other developments noted above should have a significant impact on overall broadband speeds and penetration over time, but many of these developments are just beginning to have an impact. For example, the Commission is just beginning the process of awarding Connect

[12] Press Release, *Venture Capital Investments Experience Double-Digit Increases in Dollars and Deal Volume in Q2 2012*, PricewaterhouseCoopers LLP and the National Venture Capital Association (July 20, 2012) *available at* http://www.pwc.com/us/en/press-releases/2012/2012-q2-moneytree.jhtml.

[13] Mandel, Dr. Michael, Where the Jobs Are: The App Economy, TechNet (Feb. 7, 2012), *available at* http://www.technet.org/wp-content/uploads/2012/02/TechNet-App-Economy-Jobs-Study.pdf.

[14] *Connect America Fund; A National Broadband Plan for Our Future; Establishing Just and Reasonable Rates for Local Exchange Carriers; High-Cost Universal Service Support; Developing an Unified Intercarrier Compensation Regime; Federal-State Joint Board on Universal Service; Lifeline and Link-Up; Universal Service Reform—Mobility Fund*, WC Docket Nos. 10-90, 07-135, 05-337, 03-109, GN Docket No. 09-51, CC Docket Nos. 01-92, 96-45, WT Docket No. 10-208, Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663 (2011) (*USF/ICC Transformation Order*), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-161A1_Rcd.pdf, *pets. for review pending sub nom. In re* FCC 11-161, No. 11-9900 (10th Cir. filed Dec. 8, 2011); Order on Reconsideration, 26 FCC Rcd 17633 (2011); Second Order on Reconsideration, 27 FCC Rcd 4648 (2012); Third Order on Reconsideration, 27 FCC Rcd 5622 (2012).

[15] ECONOMICS AND STATISTICS ADMINISTRATION & NTIA, EXPLORING THE DIGITAL NATION: COMPUTER AND INTERNET USE AT HOME at vi, 37 (2011) (DIGITAL NATION NOV. 2011), *available at* http://www.ntia.doc.gov/files/ntia/publications/exploring_the_digital_nation_computer_and_internet_use_at_home_11092011.pdf.; *see also* Horrigan, *Broadband Adoption and Use in America* at 5; KATHRYN ZICKUHR & AARON SMITH, PEW INTERNET, DIGITAL DIFFERENCES 7 (showing that 10 percent of non-Internet users do not use the Internet because it is too expensive), 8 (finding that 35 percent of dial-up users will not switch to broadband until the price falls) (2012) (PEW INTERNET, DIGITAL DIFFERENCES), *available at* http://pewinternet.org/~/media//Files/Reports/2012/PIP_Digital_differences_041312.pdf.

[16] *Lifeline and Link Up Reform and Modernization; Lifeline and Link Up; Federal-State Joint Board on Universal Service; Advancing Broadband Availability Through Digital Literacy Training*, WC Docket Nos. 11-42, 03-109, 12-23, CC Docket No. 96-45, Report and Order and Further Notice of Proposed Rulemaking, FCC 12-11 (rel. Feb. 6, 2012) (*Lifeline Order*).

[17] *See* Press Release, *FCC and "Connect to Compete" Broadband Fact Sheet* (Nov. 9, 2011), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2012/db0510/DOC-310924A1.pdf.

America funds to promote broadband deployment as this Report is being released. The data in this *IBDR* generally dates from several months ago, so early effects of these developments may not yet appear here.

7. As these reforms are implemented, however, and as providers continue their roll out of next generation services, the data in this report provides a benchmark for the Commission and industry to measure improvements in adoption, cost, and quality of service. Based on OECD data, the United States ranks seventh (compared to ninth at the time of the previous report) for wireless (mobile) broadband penetration on a per capita basis,[18] and ranks 15th (similar to Japan, Finland, and Canada) for wired (*e.g.*, DSL or cable) broadband penetration on a per capita basis.[19] U.S. wired broadband adoption continues to lag behind such countries as South Korea, the United Kingdom, and Germany, but exceeds adoption rates in Israel, Australia, and the EU average.[20]

8. As with past reports, the 38 countries we selected for comparison present a diverse profile of countries with developed broadband markets, including all 34 OECD countries. Our selection exceeds the requirement of the BDIA that we review broadband data for 75 communities in 25 countries.[21] With respect to speeds, our review of data on average actual download speeds reported by a sample of consumers from 38 countries (including the United States and Hong Kong Special Administrative Region of the People's Republic of China), finds that the United States ranks 24th in average actual speeds purchased and experienced by consumers. The United States ranks 17th when based on a stratified sampling technique using weighted average actual download speed.[22] We also present data comparing the speeds in select cities around the world.

9. As a result of efforts to improve data collection, this third Report also, for the first time, takes a close look at the broadband prices for both fixed and mobile service plans around the world, including detailed price information for mobile broadband plans, broken down by technology (*e.g.*, smartphones, stick modems, and tablets). We find U.S. prices for standalone fixed broadband are in the mid-level range in our 38 country survey, but are higher in higher speed tiers. We find that the prices per GB of data for fixed broadband plans with usage limits and for smartphone data plans with usage limits are on the lower end of the countries we surveyed. Within the United States, the price per Mbps declined from 2010 to 2011.

10. We also present in this Report updated demographic data for 37 countries on a sub-national basis, including the latest figures for such indicators as broadband adoption and income, population size, and population density.[23] Using this sub-national data, we are able to draw comparisons across both

[18] OECD Broadband Portal, Table 1d(2) (June 2011) (accessed March 5, 2012), *available at* http://www.oecd.org/dataoecd/21/35/39574709.xls.

[19] OECD Broadband Portal, Figure 1d(1) (June 2011) (accessed March 5, 2012), *available at* http://www.oecd.org/dataoecd/21/35/39574709.xls.

[20] OECD Broadband Portal, Table 2a (November 2011) (accessed March 5, 2012), *available at* http://www.oecd.org/dataoecd/20/59/39574039.xls. Note that the OECD considers broadband to mean transmission speeds of at least 256 kbps in one direction (*see Indicators of Broadband Coverage*, OECD Working Party on Communication Infrastructures and Services Policy at 8 (Dec. 10, 2009), available at http://www.oecd.org/dataoecd/41/39/44381795.pdf), which is considerably slower than the Commission's broadband definition. *See* ¶ 21 *infra*, for discussion of the Commission's broadband definition.

[21] 47 U.S.C. § 1303(b)(1). For Appendix D (demographic data) we have data at the sub-national level (equivalent to states or larger) for 37 countries. *See* Appendix D. In Appendix F, we examine broadband speeds in three cities (including capitals) in 38 countries. *See* Appendix F. Together, this represents well over 75 communities in 25 countries.

[22] For a more detailed discussion of stratified sampling, *see* n. 84, *infra*.

[23] We did not have demographic data for Hong Kong, New Zealand, Singapore, and Switzerland. *See* Appendix A.

international and domestic cities and states, and often the intra-United States variation is greater than the inter-country differences. In particular, differences in population density, dispersion, and income may create significant variations. The lower population density and size of the United States present unique challenges.

11. As we indicated in the previous reports, available data sources on international broadband are incomplete and generally challenging to compare because of significant gaps and variations in data collection methodologies across countries, limiting the conclusions we can draw from the data. However, this Report provides an update on steps the Commission is taking to obtain better, more globally standardized broadband data in order to help the Commission better meet its statutory responsibilities. In the future, we hope to build further on the OECD's data collection efforts. In the meantime, the information presented today should inform industry and Commission efforts to drive improvements in adoption, cost, and quality of broadband.

II. BACKGROUND

A. Requirements of the BDIA

12. The Broadband Data Improvement Act (BDIA) requires the Commission to include in its annual broadband progress report "information comparing the extent of broadband service capability (including data transmission speeds and price for broadband service capability) in a total of 75 communities in at least 25 countries abroad for each of the data rate benchmarks for broadband service utilized by the Commission to reflect different speed tiers."[24] The BDIA directs the Commission to assess broadband capability in international communities comparable to U.S. communities with respect to population size, population density, topography, and demographic profile.[25] The Commission is also directed to include "a geographically diverse selection of countries" and "communities including the capital cities of such countries."[26] The Commission must "identify relevant similarities and differences in each community, including their market structures, the number of competitors, the number of facilities-based providers, the types of technologies deployed by such providers, the applications and services those technologies enable, the regulatory model under which broadband service capability is provided, the types of applications and services used, business and residential use of such services, and other media available to consumers."[27]

B. Data Presented in the *2011 IBDR*

13. The International Bureau published its second report under the BDIA last year. In that report we presented a wide range of broadband data gathered from public sources.[28] Commission staff compiled advertised broadband prices from the websites of broadband providers in 38 countries (including the United States).[29] For 35 countries, staff also gathered community-level broadband adoption, demographic, income, and education data from OECD collections, the European Commission's regional

[24] 47 U.S.C. § 1303(b)(1).

[25] *Id.* § 1303(b)(2).

[26] *Id.*

[27] *Id.* § 1303(b)(3).

[28] *International Comparison Requirements Pursuant to the Broadband Data Improvement Act International Broadband Data Report*, IB Docket No. 10-171, Second Report, 26 FCC Rcd 7378, Appendices B-G (2011) (*2011 IBDR*).

[29] *2011 IBDR*, 26 FCC Rcd 7378, Appendices C and D.

database,[30] and from national government agencies.[31] We presented econometric analyses of how population size, population density, income, and education affect broadband adoption at a sub-national or "community" level.[32] Our analysis suggested a correlation between broadband adoption and (1) communities with larger populations, (2) communities with higher population density, and (3) communities with higher income. The same model, however, did not detect a statistically significant relationship between education and broadband adoption.[33] Staff also compiled information about broadband policies and the extent of competition in the broadband market in 40 countries (including Hong Kong).[34] In an effort to give some sense of the actual speeds foreign consumers experience, for the *2011 IBDR* we surveyed the average actual download speeds determined by Ookla (proprietor of speedtest.net)[35] in 15 foreign capital cities, and compared those speeds to Ookla-determined speeds in 15 U.S. cities with comparable populations. We found that some large European and Asian cities exhibit a significant edge over comparable U.S. cities in reported download speeds, but also that reported speeds for some other international cities are roughly comparable to speeds in many U.S. cities.

C. Efforts To Improve Data Collection

14. Soon after the release of the *2011 IBDR*, the Commission sought comment in the *Eighth Broadband Progress Notice of Inquiry* on, among other things, how to improve upon the *2011 IBDR's* data and analysis.[36] The Commission also sought comment generally on preparation of the next *IBDR* and how best to include the international comparison in the *Eighth Broadband Progress Report*. None of the filed comments specifically addressed these questions, though several possible improvements for the *IBDR* were suggested in *ex parte* comments, such as determining differences in broadband consumption (*e.g.*, by a megabits/month metric) and ascertaining the gap between advertised and actual broadband speeds across countries.[37] In its comments, the United States Telecom Association (USTelecom) cited

[30] Eurostat is the Statistical Office of the European Communities, located in Luxembourg. Its task is to provide the European Union with statistics that enable comparisons between countries and regions. *See* http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/introduction.

[31] *See 2011 IBDR*, Appendix D. Due to differences in data availability, there were some differences in the countries included for each dataset in the *2011 IBDR*. For example, in the event that we lacked demographic or price data for a given country, we provided market and regulatory/policy information for it in Appendix E. *See 2011 IBDR*, 26 FCC Rcd at 7388, n. 78. We use the same approach with this *IBDR*.

[32] *See 2011 IBDR*, Appendix G.

[33] *See id.*

[34] *See 2011 IBDR*, Appendix E. The Appendix E dataset has more countries (40) than the other datasets because it provided information for countries where other data (price, speed, or demographics) was not available. For instance, the *2011 IBDR* lacked demographic data for Mexico, but did include price and Appendix E data for Mexico. Similarly, the *2011 IBDR* lacked price data for Romania, but did include demographic and Appendix E data for Romania.

[35] Ookla is one of the largest providers of speed test services for Internet users across the globe. Ookla determines speed and cost indices from the data it collects, which it provides on its website, www.netindex.com. The Commission uses Ookla's and M-Lab's speed testing data tools to analyze broadband quality and availability on a geographic basis across the United States. *See* http://www.broadband.gov/qualitytest/about/#qualitytest.

[36] *Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications of 1996, as Amended by the Broadband Data Improvement Act*, 26 FCC Rcd 11800, 11812-13 (2011).

[37] Memorandum re: *Ex Parte* Meeting in GN Docket No. 11-121 from Strategic Analysis and Negotiations Division, International Bureau, FCC (Sept. 15, 2011).

data that demonstrate the United States is "among world leaders in Internet usage."[38] USTelecom argues that the domestic investment in broadband has made U.S. networks "capable of accommodating massive data traffic growth . . . generating the most traffic use per user among industrialized nations except South Korea."[39] In this report, we focus on country demographics, broadband speeds, and broadband prices. We anticipate looking at usage data in future reports if appropriate data is available.

15. In an effort to standardize the methods countries use to collect broadband data, the Commission, working together with the State Department and the Department of Commerce, and through the OECD, started an initiative to collect more reliable and granular international data on broadband deployment and adoption internationally. The first concrete result of these efforts was a workshop hosted by the Commission at its Washington, D.C. headquarters in October 2011.[40] In Section III.D below, we discuss the results of this workshop and next steps.

D. Data and Analysis for the *2012 IBDR*

16. Based on the feedback we have received and recognizing the importance of mobile broadband, we add more detailed and recent national-level price data for mobile broadband service offerings to this year's *IBDR*.[41] Wireless broadband subscriptions topped 500 million in OECD countries by the end of 2010 (compared to 300 million fixed broadband subscriptions).[42] According to Cisco, global mobile data in 2011 (597 petabytes per month) more than doubled for the fourth consecutive year.[43] Cisco also reports that all mobile data traffic generated in 2011 was "eight times the size of the entire global Internet in 2000."[44] To better understand this significant segment of the broadband market, we have included a survey of mobile broadband prices and speeds in this year's report. The resulting fixed and mobile price dataset (gathered from service provider websites) is over twice as large as the dataset made available in the *2011 IBDR*.[45]

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[38] USTelecom Comments at 10. USTelecom, the one commenter who addressed international issues, contends that the United States "compares very favorably in a number of international comparisons, which raises questions about the validity of statements" by those who suggest that the United States is lagging. *Id.* at 7. USTelecom cites OECD data on telecommunications investment as evidence of U.S. leadership (arguing that the U.S. annual average investment of $249 per capita in broadband telecommunications networks between 1997 and 2007 exceeds the OECD average of $155). *Id.* USTelecom also argues that the greater level of competition for broadband services in the United States sets it apart (citing data that 82% of U.S. households can choose between two or more wired competitors, compared to 43% of European Union households that have such a choice). *Id*. at 9.

[39] USTelecom Comments at 10. For 2009, the USTelecom calculated (based on Cisco Visual Networking Index and ITU data) that the average IP traffic per Internet user in the United States was 19.2 GB/month, second highest to South Korea, with 40.7 GB/month.

[40] *See* OECD Technical Workshop, Broadband and Its Impact on Consumers and Economies: Developing a New Framework for Future Metrics, *available at* http://transition.fcc.gov/ib/Metrics_Workshop/agenda.pdf.

[41] The first *IBDR*, released in 2010, had no mobile price data and the *2011 IBDR* contained limited mobile price data. Prior criticism of the IBDR had been directed at the lack of review of mobile broadband data. *2011 IBDR*, 26 FCC Rcd at 7390.

[42] "Internet Economy: Wireless Broadband Subscriptions Top Half a Billion, says OECD," OECD News Release, June 22, 2011. By January 2012, 101.3 million mobile subscribers in the United States were using data-hungry smartphones. "US Smartphone users now over 100 Million, Android Increases Market Share," Digital Trends (Trevor Moog, March 7, 2012).

[43] Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2011 - 2016, at 1, *available at* http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf.

[44] *Id*.

[45] *See* Appendix B *infra*. With a few exceptions (*e.g.*, New Zealand's TelstraClear, on whose website regional availability of some services was clearly indicated), service plans are presumed to be available throughout the country where offered.

17. In addition, staff again gathered community-level broadband adoption, demographic, income, and education data from OECD collections, the European Commission's regional database,[46] and from national government agencies.[47] Staff used Ookla speed test data from 38 countries[48] as the basis for an analysis of international broadband speeds, building substantially on the more limited examination of broadband speeds we undertook in the *2011 IBDR*.[49] This actual speed data includes a discussion of the gap between advertised and actual speed. Finally, staff gathered updated information about the extent of competition in broadband markets, government policies, and mobile broadband adoption in various countries around the world.[50] We discuss the data that we collected in more detail below.

III. DISCUSSION

18. In preparing this *IBDR*, Commission staff have reviewed a number of data sources and analyzed various rankings that compare broadband service capability in the United States and other countries.[51] The best currently available data set comparing the United States to other countries along a number of metrics appears to be from the OECD, which collects data on various broadband deployment, adoption, and usage metrics and publishes rankings of its member countries.[52]

19. The OECD's deployment data ranks countries based on particular technologies, rather than overall coverage. The OECD has not updated its deployment data since we last reported it in the *2011 IBDR*. The U.S. ranking in these surveys ranges from 27th out of 30 in DSL coverage[53] to first out of 28 in cable modem coverage.[54] The U.S. ranks sixth out of 16 in fiber-to-the-home (FTTH) coverage[55] and eighth out of 29 in 3G mobile wireless coverage.[56] As the OECD notes, however, its coverage rankings are compiled using metrics that may not be fully comparable across countries, thus limiting their utility.[57] For example, deployment is measured using different indicators and different reference dates across various countries.[58]

20. The OECD's more recent adoption data (from June 2011) also ranks countries based on particular technologies, rather than all broadband technologies inclusively. As the most populous member of the OECD, in terms of sheer number of wireless broadband subscribers, the United States

[46] Eurostat is the Statistical Office of the European Communities, located in Luxembourg. Its task is to provide the European Union with statistics that enable comparisons between countries and regions. *See* http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/introduction.

[47] *See* Appendix D *infra*.

[48] We used the same set of 38 countries for our price and speed analyses. *See* Appendix A, *infra*.

[49] *See* Appendix F *infra*.

[50] *See* Appendix E *infra*.

[51] Differences between which countries are included for each dataset in this *IBDR* are primarily due to data availability. *See* Appendix B *infra*.

[52] OECD Broadband Portal, *available at* http://www.oecd.org/document/36/0,3746,en_2649_33703_38690102_1_1_1_1,00.html.

[53] OECD Broadband Portal, Table 3d (2009 or latest year).

[54] OECD Broadband Portal, Table 3e (2008 or latest year).

[55] OECD Broadband Portal, Table 3f (2009 or latest year).

[56] OECD Broadband Portal, Table 3g (2009 or latest year).

[57] OECD Broadband Portal, http://www.oecd.org/document/46/0,3746,en_2649_37441_39575598_1_1_1_37441,00.html.

[58] *See id*. and OECD Broadband Portal, 2a. Households with broadband access (1), 2000-09, *available at* http://www.oecd.org/dataoecd/20/59/39574039.xls.

ranks first out of 34 countries with 203,180,000 (by comparison, the second-ranked country, Japan, has 101,869,228 wireless subscriptions).[59] The United States also ranked first in the sheer number of fixed (wired) broadband subscriptions with 84,672,000 (again the second-ranked country is Japan, with 34,360,672 wired subscriptions).[60] The United States ranks 15th out of 34 countries for overall fixed (wired) broadband subscriptions (27.3) per 100 inhabitants.[61] Breaking the fixed subscriber numbers down by technology, the U.S. ranking in these surveys ranges from 25th out of 34 in DSL adoption[62] to third out of 34 in cable modem adoption,[63] to 12th out of 34 in fiber-to-the-home (FTTH) adoption.[64] The U.S. ranks seventh overall (out of 34 countries) in total wireless broadband subscriptions (65.5) per 100 inhabitants.[65] In addition to measuring fixed or wired broadband adoption on a subscription-per-inhabitant basis, the OECD's data also tracks member countries on the basis of the percentage of households that have fixed broadband. Under this metric, the OECD ranks the United States 14th out of 34.[66]

21. As the OECD notes, however, numerous market, regulatory, and geographic factors determine penetration rates, prices, and speeds, and as such country comparisons should be undertaken with caution.[67] Also, adoption is measured using different indicators and different reference dates across various countries.[68] The U.S. ranking according to these adoption metrics is also likely affected by the OECD's definition of broadband; it considers transmission speeds of at least 256 kbps in one direction to be broadband service. This is considerably slower than the 4 Mbps down/1 Mbps up transmission speed by which the Commission defines broadband.[69]

22. Further, where a particular country falls in these rankings may be influenced by population density and dispersion, income, and other factors. USTelecom notes that when comparing countries, one should take into account the importance of variation in population density.[70] USTelecom observes that

[59] OECD Broadband Portal, Table 1(d)(2) (June 2011).

[60] OECD Broadband Portal, Table 1(d)(1) (June 2011).

[61] OECD Broadband Portal, Table 1(d)(1) (June 2011).

[62] *Id*.

[63] *Id*.

[64] *Id*.

[65] The OECD includes satellite and fixed wireless subscriptions in its definition of wireless broadband. *See* http://www.oecd.org/document/46/0,3746,en_2649_34225_39575598_1_1_1_1,00.html. The Commission does not include satellite subscriptions in its broadband deployment determination and considers fixed wireless to be a fixed service, much like cable or DSL, for purposes of Form 477. *See Eighth 706 Report* at ¶¶ 31, 41.

[66] OECD Broadband Portal, Table 2a (2010 or latest year) (*see* http://www.oecd.org/dataoecd/20/59/39574039.xls). Note that some countries (*e.g*., Japan and Korea) include some wireless subscriber data for this metric. The previous year, the United States ranked 12th out of 33 countries in this category. *See 2011 IBDR* at ¶ 9. A fixed broadband connection is likely to be shared within a household whereas multiple people within a single household may each have their own mobile broadband connection, thus the OECD tracks fixed broadband penetration using both metrics.

[67] OECD Broadband Portal, http://www.oecd.org/document/46/0,3746,en_2649_34225_39575598_1_1_1_1,00.html.

[68] *See* OECD Broadband Portal, notes for Tables 1(d)(1) and (2). To elaborate, comparisons between countries may not be precise when data is collected at different times or when countries use different methods of determining what constitutes a broadband subscription.

[69] *See Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, Amended by the Broadband Data Improvement Act*, GN Docket Nos. 09-137, 09-51, Report, 25 FCC Rcd 9556, 9558, ¶ 4 (2010) (*2010 Sixth Broadband Progress Report*).

[70] USTelecom Comments at 7.

the United States has about one quarter the population density of Europe, one-tenth that of Japan, and one-fifteenth that of South Korea.[71] As discussed throughout this *IBDR*, we recognize the need for better data on these issues and have initiated efforts to improve available data, both domestically and internationally. In the meantime, we have continued to compile and analyze the international data that is available.

A. Elements of "Broadband Service Capability"

23. The BDIA requires that the Commission gather information concerning "the extent of broadband service capability (including data transmission speeds and price for broadband service capability)" in foreign communities.[72] Like last year, we understand the responsibility of collecting information on "the extent of broadband service capability" to require an inquiry into the availability of broadband service, which in turn includes factors such as available advertised and/or actual speeds, service quality, and price and affordability to broadband customers.[73] We consider these characteristics here to the extent currently available data allow.

1. Advertised and Actual Speed

24. The BDIA requires the Commission to collect information on "data transmission speeds" for broadband services. *Speed* is a quantitative description of the information transfer rate of a broadband Internet access service, and Commission staff has defined speed as "data signaling rate," as expressed in bits per second.[74] The *Sixth Broadband Progress Report* increased the Commission's speed benchmark for broadband to 4 Mbps download and 1Mbps upload because "network capabilities, consumer applications and expectations… have evolved in ways that demand increasing amounts of bandwidth."[75] The 2010 National Broadband Plan recommended a goal of affordable access to broadband with actual speeds of at least 100 Mbps to 100 million U.S. households by 2020.[76] Investment in faster broadband is critical for a vibrant economy.

25. For this report, we have again collected both advertised and actual speed data for U.S. and foreign communities.[77] Advertised speeds typically feature "up to" download and upload speeds.[78] Different broadband providers in different parts of the world may not use the same methodology for determining their advertised speeds, and providers vary on how well advertised speeds match actual delivered speeds. For example, a November 2011 U.K. broadband study (conducted by the U.K. regulator Ofcom with the assistance of SamKnows) revealed an average advertised speed of 16.3 Mbps, with a corresponding average actual speed of 7.6 Mbps—a significant gap between the advertised and actual speed that U.K. consumers experience.[79] By contrast, the most recent U.S. data on actual speed

[71] *Id*.

[72] 47 U.S.C. § 1303(b)(1).

[73] *Cf. Eighth 706 Report at* ¶ 27.

[74] *See Consumer and Governmental Affairs Bureau Seeks Comment on "Need for Speed" Information for Consumers of Broadband Services*, Public Notice, DA 11-661, n.1 (April 11, 2011).

[75] *2010 Sixth Broadband Progress Report*, 25 FCC Rcd at 9558, ¶ 4.

[76] Omnibus Broadband Initiative (OBI), FCC, Connecting America: The NationalL Broadband Plan, GN Docket No. 09-51 at 9 (2010) (2010 National Broadband Plan).

[77] *See* Appendices B and F.

[78] Different broadband providers in different parts of the world may not use the same methodology for determining their advertised speeds.

[79] *UK fixed-line broadband performance, November 2011: The performance of fixed-line broadband delivered to UK residential consumers*, Ofcom, Feb. 2, 2012, at 5, *available at* http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/Fixed_bb_speeds_Nov_2011.pdf; *see also* (continued…)

shows that American ISPs deliver on average 96% of advertised speeds during peak intervals, with five ISPs routinely meeting or exceeding advertised rates.[80] In an attempt to address the gap that exists between advertised and actual speeds in the U.K., the Advertising Standards Authority (ASA) and Committee of Advertising Practice (CAP) issued guidance (effective April 2012) providing that ISPs may advertise a given broadband speed only if at least 10% of the customer base can achieve it.[81]

26. As with the *2011 IBDR*, for this Report we have collected data on advertised speed from broadband provider websites. We obtained advertised speeds and prices from the publicly accessible websites of mobile and fixed broadband providers in 38 countries. We also examined the OECD's most recent data on advertised speed for the 34 OECD countries.[82] Our analysis of actual speed data is based on the publicly available raw source data provided by Ookla, proprietor of speedtest.net, on their Net Index site. This dataset comprises approximately 14.4 million observations of daily broadband speeds and spans over 12,000 cities from 159 countries from 2008 to December 2011.

27. Appendix F contains our analysis of the actual speed data, which examines the data on both a country and city basis. Using the aggregated data, we ranked 38 countries based on a weighted average of the city mean speeds, with weights determined by the number of tests per city, and using a stratified sample technique to offset changes in average speeds based on differences in city participation across countries.[83] Because, as we show in Appendix F, aggregate national rankings can be misleading, we also report speed results at the city level.

28. Below are some highlights from our analysis of Ookla's actual speed data in 38 countries:

- The shortfall index, or the percentage difference between advertised and actual speed, declined in all countries in 2011 from 2010. In the United States, the shortfall index declined from 7.06% to 6.80% based on self-reported data from consumers.
- The United States shows a large increase in the average speed with the percentage of tests reporting speeds of 10 Mbps or higher increasing from 30% in 2009 to 80% in 2011.
- The United States ranks 24th (11.6 Mbps) in terms of actual download speeds based on the weighted averages of all city data.

(. . . continued from previous page)
http://www.ispreview.co.uk/story/2012/02/02/ofcom-confirms-uk-average-broadband-isp-downloads-speeds-hit-7-6mbps.html.

[80] *2012 Measuring Broadband America July Report: A Report on Consumer Wireline Broadband Performance in the U.S.*, FCC's Office of Engineering and Technology and Consumer and Governmental Affairs Bureau, *available at* http://www.fcc.gov/measuring-broadband-america/2012/july.

[81] *See* Jump in U.K. Broadband Speeds, Ofcom News Release, Feb. 2, 2012, *available at* http://media.ofcom.org.uk/2012/02/02/jump-in-uk-broadband-speeds/; UPD Ofcom Confirms UK Average Broadband ISP Download Speeds Hit 7.6Mbps, ISPreview (Feb. 2, 2012), *available at* http://www.ispreview.co.uk/story/2012/02/02/ofcom-confirms-uk-average-broadband-isp-downloads-speeds-hit-7-6mbps.html; Broadband: A need for speed, U.K. Advertising Standards Authority and Committee of Advertising Practice, available at http://www.asa.org.uk/Resource-Centre/Hot-Topics/Broadband-advertising.aspx. One study of advertised broadband speeds in the U.K. after the ASA/CAP guidelines went into effect showed that advertised "up to" speeds in the fast (*i.e.*, "up to" speeds below 30 Mbps) tier fell by 33%, from 21.66 Mbps to 14.58 Mbps. *See* "Stricter Rules Cause UK Advertised Broadband ISP Speeds to Fall by 33 Percent," *ISPReview* (April 24, 2012), *available at* http://www.ispreview.co.uk/index.php/2012/04/stricter-rules-cause-uk-advertised-broadband-isp-speeds-to-fall-by-33-percent.html.

[82] OECD Broadband Portal, Average advertised download speeds, by country (Sept. 2011), Table 5(a), *available at* http://www.oecd.org/dataoecd/10/53/39575086.xls.

[83] We use sample weights (*i.e*. the number of tests taken) instead of population weights (population in a city). The advantage of using sample weights is that it puts greater weight on speed numbers when they are generated by more tests rather than a few tests. Using population weights would not achieve this.

- The United States ranks 17th (12.5 Mbps) when based on a stratified sampling technique using weighted average actual download speed.[84]
- When comparing all 50 states with 37 foreign countries in our dataset, we find that Massachusetts is ranked 11th, Delaware 13th and the 15th, 16th and 17th places are taken by Rhode Island, Maryland, and New York.
- The United States as a whole ranks in the middle in tests related to latency, jitter, and packet loss. Again, a more detailed look at state measurements shows wide variations between states.

2. Price

29. The BDIA directs the Commission to collect information regarding the price of broadband service capability.[85] A number of international organizations routinely collect and compare broadband prices across countries.[86] OECD's most recent broadband price data ranks the United States sixth most expensive among 34 OECD countries in terms of median monthly broadband prices.[87] Conversely, in its Measuring the Information Society 2011 report, the International Telecommunication Union (ITU) stated that "[c]ountries with the relatively cheapest broadband prices are high-income economies and include Monaco, Macau (China), Liechtenstein, the [United States] and Austria."[88]

30. We recognize that the complexity in the pricing of residential broadband services makes any empirical analysis difficult. The features and quality of broadband service vary across countries and providers; service is often offered under a multi-part pricing scheme;[89] and broadband is frequently purchased as part of a bundle of services.[90] Price comparisons are also difficult because different

[84] The aggregate United States ranking presented above (24th) would be a sufficient basis for international comparison if the Ookla data set had speed data for all cities for the 38 countries in our sample. However, given that it does not have data for every city in each of these countries, the aggregate rank may be biased. A stratified sampling would choose an optimal number of cities from each population strata to reflect the actual dispersion of cities in a country. For example, suppose a country has 90 small cities (assume all have low average speed) and 10 large cities (assume all have high average speed). But Ookla may have data for only 10 large cities and 25 small cities. In that case the aggregate rank will show a higher speed that we would actually get if we had the data for all cities. The stratified sampling would involve choosing 90% from the small city sample and 10% from the large city sample to come up with an aggregate ranking. A stratified sampling approach divides the sample of cities into different non-overlapping bins according to their population level, and then draws a sample from each bin. If large cities have inherently different broadband characteristics from smaller and sparsely populated cities, then a stratified sample will achieve greater precision than an aggregate ranking. *See* Appendix F for a more detailed discussion of stratified sampling.

[85] *See* 47 U.S.C. § 1303(b)(1).

[86] *See, e.g.*, OECD Broadband Portal, *available at* http://www.oecd.org/document/36/0,3746,en_2649_33703_38690102_1_1_1_1,00.html.

[87] *See*, OECD Broadband Portal, Table 4c (Sept. 2011 data), *available at* http://www.oecd.org/dataoecd/22/42/39574970.xls. The OECD price ranking is based on cost per megabit/second.

[88] Measuring the Information Society 2011, ICT Price Basket, http://www.itu.int/ITU-D/ict/ipb/; *see also* http://www.itu.int/ITU-D/ict/publications/idi/material/2011/MIS2011-ExceSum-E.pdf. The ITU price ranking is based on price as a percentage of GNI per capita.

[89] For example, the broadband service price often includes an installation charge, a monthly service fee, and possibly equipment rental charges.

[90] *See, e.g.*, Scott Wallsten, Understanding International Broadband Comparisons: 2009 Update (Technology Policy Institute Paper, June 2009), *available at* http://ssrn.com/abstract=1434570 (discussing difficulties in comparing broadband prices due to differing characteristics of broadband services and the tendency of consumers to purchase services in bundles).

providers frequently adopt different price structures for broadband Internet access service. For example, an offering of unlimited broadband service with a maximum download speed of 5 Mbps for an up-front fee, a flat monthly recurring fee, and a two-year contract with an early termination fee, is not easily comparable to a 5 Mbps offering from another provider that charges a different up-front fee, monthly recurring fees that vary with usage, the ability to cancel service at any point with no penalty or termination fee, and a usage limit. When broadband is bundled with other services, such as telephone or video service, it becomes even more complicated to identify the price of the broadband service. Promotional offers further complicate comparisons. In our research, we observed that broadband offerings around the world vary with respect to download and upload speeds; type of technology used to deliver broadband services; limitations on use, including limits on upload and download volumes; determinations of use limits (download traffic vs. a combination of upload and download traffic vs. download traffic at peak/non-peak usage times); and consequences of exceeding usage limits (*e.g.*, access speed reductions, surcharges, service cut-off).

31. In pursuit of a more comprehensive dataset to enable price comparisons, Commission staff compiled a dataset of publicly available advertised pricing information for residential broadband services in 38 countries (including the United States), most of which are members of the OECD. Our research this year generated a much richer dataset than the one included in either of the previous two *IBDRs*. In Appendix B we list 1682 fixed plans and 1765 mobile plans for 38 countries, including the United States, whereas in the *2011 IBDR* we provided data on 1554 (mostly fixed[91]) plans for 38 countries. Staff collected this pricing information between August 2011 and February 2012.[92] The fixed dataset includes a range of residential broadband offers by all major Internet service providers for these 38 countries.[93] The mobile dataset includes smartphone plans, wireless USB stick modem plans, tablet plans, and netbook plans offered by all major mobile providers in the same 38 countries.[94] The countries in the dataset represent a broad range of broadband markets, including countries of various sizes and population

[91] The *2011 IBDR* included a small number of wireless plans offered by fixed providers (*e.g.*, wireless USB stick modem plans that might be offered as a value-added service by a cable operator). We did not include any wireless ISPs, *per se*, in the *2011 IBDR*.

[92] *See* Appendix B *infra*. We assembled the data by visiting the websites of broadband providers serving the countries and communities in our sample. In order to mitigate the effects of variations in a particular broadband provider's prices over time, we visited the websites of providers and downloaded the relevant information at one specific point in time. Thus, some provider data was collected in August 2011 while other provider data might have been collected in February 2012, but our sample does not reflect pricing changes that any individual provider may have implemented over the August-to-February period. Our price data reflects only what a given provider was offering at the specific point in time we accessed its website. For some countries in the dataset, we were able to determine whether the offerings were on a national or community level. Many advertised offerings were national in scope, though some were listed for particular cities or on an "as available" basis. Unless noted otherwise, we assume that a service offering is available nationwide. In the event that a provider website did not indicate if a data cap was in place for a given plan, we assumed that said plan had no data cap. Because we obtained the information for the dataset at specific points in time, we were not able to determine which offers are regularly available and which are significant departures from regularly available offers. Therefore, while ideally we would include only widely and regularly available offerings, it is possible we captured information on some non-standard offers such as special, promotional, or other limited offers.

[93] For each of the European countries in the dataset, we obtained a list of incumbent operators and their competitors from the European Commission's 2010 report on broadband Internet access prices. *See* Broadband Internet Access Cost (BIAC), Final Report, prepared for the European Commission, Information Society and Media Directorate-General, by Van Dijk Management Consultants, January 2010, Brussels, Belgium, available at http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/eda/biac_2009.pdf. This was supplemented with staff research into incumbent operators and their competitors, for both European and non-European countries.

[94] *Id*.

densities from every continent except Africa and Antarctica. The countries we examined range from emerging economies such as former Soviet republics and Mexico, to mature economies such as Germany and Japan. We include Israel and Singapore in this year's report as well. In Appendix B, we have converted all prices to U.S. dollars based on both 2011 purchasing power parity (PPP)[95] and 2010 exchange rates.[96] Converting prices through both methods enables more meaningful comparisons.[97]

32. For each broadband service offering (both fixed and mobile), the dataset includes upload and download[98] speeds, limitations on data usage, and information on the types of technology offered, including DSL, cable, fiber-to-the-home, fixed wireless, satellite, and public WiFi, for fixed services, and 3G or 4G for mobile. The dataset includes information on advertised monthly recurring charges and nonrecurring charges such as connection and modem/equipment fees, to allow for a more complete pricing analysis of each broadband Internet service offering. The dataset includes not only advertised price but also promotional discounts such as those associated with online sign-up and longer service contracts. Data on advertised and promotional prices may be helpful for analyzing competition because advertised prices are focused on winning new customers or keeping customers who may be considering switching providers. The fixed dataset also contains a number of offers that include services, such as voice or video, which are bundled with a broadband service. The mobile dataset also contains bundle offers, typically associated with smartphone plans, which have data, voice, and messaging components.

[95] PPPs are currency conversion rates that convert to a common currency and equalize the purchasing power of different currencies. In other words, they eliminate the differences in price levels between countries in the process of conversion. PPPs show the ratio of the prices in national currencies of the same good or service in different countries. For example, if the price of a hamburger in France is €2.84 and the price of an equivalent hamburger in the United States is $2.20, then the PPP for a hamburger between France and the United States is €2.84 to $2.20, or €1.29 to the dollar. This means that for every dollar spent on hamburgers in the United States, €1.29 would have to be spent in France to obtain the same quantity and quality of hamburgers. *See* OECD, Statistics Directorate webpage, *available at* http://oecd.org/department/0,3355,en_2649_34357_1_1_1_1_1,00.html; OECD, Statistics Directorate FAQ webpage, *available at* http://oecd.org/faq/0,3433,en_2649_34357_1799281_1_1_1_1,00.html#1799063. The PPP conversion is an accepted method of equalizing purchasing power in different countries, thereby enhancing comparative studies. Tim Callen, *PPP Versus the Market: Which Weight Matters?*, Finance and Development, Vol. 44, no. 1, March 2007, International Monetary Fund, *available at* http://www.imf.org/external/pubs/ft/fandd/2007/03/basics.htm. It accurately reflects the cost of a product or service relative to other items in a particular country and can allow a more valuable international comparison than merely comparing prices based on exchange rates in certain circumstances. International exchange rates, unadjusted for purchasing power, are most relevant when goods and services are traded across international borders. Generally, non-traded services or products are cheaper in less affluent countries than in more affluent countries because of lower wages and income to afford these services. This can vary, though, depending on how much the service makes use of goods that are traded across international borders. Failure to account for such differences may understate the cost of those services, relative to the economy, in less affluent countries. Nonetheless, we have also included in Appendix B the data using current exchange rates to provide an additional perspective. We believe that use of the exchange rates, unadjusted for purchasing power, provides a nominal measure of broadband service prices across countries, while the use of the PPP conversion factor not only converts the local currencies to a common currency but also measures value of broadband services at a uniform price level. *Id*.

[96] Exchange rates fluctuate on a daily basis. The exchange rates (2010) and PPP conversion factors (2011) we used for each country are annual rates and factors obtained from the International Monetary Fund, World Economic Outlook Database, September 2011.

[97] Meaningful international PPP price comparisons are easier to achieve when the prices paid are for the same or similar service in each country. Since broadband service varies in terms of upload and download speeds, non-recurring charges, and promotional discounts, we have assembled data on various service attributes and associated those attributes with the price data for our international price comparisons. We believe this approach enables more useful international price comparisons.

[98] In some cases, providers did not indicate upload speeds on their websites. *See* Appendix B.

Since fixed and mobile service bundles can have a wide assortment of components, these variations present additional layers of complexity for comparison and analysis.

33. To facilitate analysis of the dataset, we first estimate the total amount a customer pays over the life of a contract that accounts for all recurring and non-recurring fees and rebates such as promotional discounts, one-time fees, equipment fees, and duration of contract. We then calculate the monthly net price and convert all prices to U.S. dollars based on both current exchange rates and purchasing power parity. We use a simple average to compute the country price because plan level subscribership data is unavailable, and thus any average price comparison implicitly assumes uniform subscribership of all plans. Because of this, these price comparisons may not reflect actual consumer experiences. We also note that the prices gathered by staff are based on advertised speeds in each country, and therefore may overstate actual speeds seen in a country. As noted above, these prices are also complicated by bundling offers, usage limits, and other plan characteristics. For mobile broadband, we also do not include device charges, and to the extent that a plan includes a subsidized device, the price will appear more expensive. However, using the available data, we compared average prices across countries, using speed tiers and usage limits. Some of our findings from the price data include:

- Prices (in 2011 PPP) and speed for residential fixed stand-alone broadband plans
    - The United States is 14th out of 24 countries in the 1-5 Mbps speed tier (advertised) with an average stand-alone broadband plan price of $35. The lowest advertised price for stand-alone services is in Hong Kong at $21.50, while the highest charges are found in Switzerland at $119.
    - The United States is 21st out of 33 countries in the 5-15 Mbps speed tier (advertised) with an average stand-alone broadband plan price of $44. The lowest advertised price for stand-alone services is in Slovakia at $21, while the highest charges are found in Switzerland at $185.
    - The United States is 26th out of 32 countries in the 15-25 Mbps speed tier (advertised) with an average stand-alone broadband plan price of $56.50. The lowest advertised price for stand-alone services is in Slovakia at $18, while the highest charges are found in Switzerland at $180.
- Price per GB for fixed broadband with usage limits (*i.e.*, cost per volume of data, not accounting for speed)
    - The United States is ranked third out of 16 countries with an average price of $0.76/GB. The lowest price is in Denmark with $0.20/GB and the highest is in Bulgaria with $26/GB.
- Price per GB for smartphone data plans with usage limits (not accounting for speed)
    - The United States is ranked ninth out of 37 countries with an average price of $10/GB. The lowest cost is in Iceland with $4/GB and Mexico is one of the highest with $95/GB.
- Price per GB for smartphone data plans without usage limits (not accounting for speed)
    - The United States is ranked 11th out of 19 countries with an average price of $52. The lowest cost is in Finland with $5 and Portugal is the highest with $149.
- Price per GB for stick modem mobile data plans with usage limits (not accounting for speed)
    - The United States is ranked 24th out of 35 countries with an average price of $10/GB. The lowest cost is in Finland with $1/GB and France is one of the highest with $19/GB.
- Price per GB for tablet mobile data plans with usage limits (not accounting for speed)

- The United States is ranked 17th out of 30 countries with an average price of $11/GB. The lowest cost is in Denmark with $2/GB and Hong Kong is one of the highest with $110/GB.

B. Community-Level Comparisons

34. In addition to requiring the Commission to gather data on broadband service capability, the BDIA directs the Commission to compare broadband development in communities that are similar to U.S. communities in terms of population size and density, topography, and demographic profile.[99] In view of the use of the phrase in the BDIA and consistent with our approach in previous reports, for purposes of this Report we again interpret "community" as a geographical unit smaller than a nation-state.[100]

35. Following past practice and the BDIA's goal of developing a geographically diverse and detailed set of data on international broadband, we use two criteria to guide the selection of countries and communities. The first is *inclusivity*: We attempt to capture as full an international profile as possible, embracing communities from all parts of the world, while also focusing on those countries that have more developed broadband markets. The second is *data availability*: We include only communities for which a substantial set of relevant information is available. These two criteria result in a dataset that exceeds the statutory minimum requirements of 25 countries and 75 communities comparable to U.S. communities, and includes communities from almost all nations with the most broadband deployment.[101] We believe that the criteria that we have used for choosing communities and offers for comparison are squarely in line with what the BDIA requires. In instructing us to include a "geographically diverse selection of countries,"[102] we do not believe that Congress intended for us to use a random sample of countries. Rather, the BDIA requires the Commission choose communities that are similar to U.S. communities, which suggests communities with higher income and education levels, and better broadband service, than communities in poorer, less developed countries.

36. For each community in the dataset, we examine population size and density, and a number of additional criteria useful for building a "demographic profile." In assembling our first two *IBDRs*, we reviewed major public databases of economic, social, and demographic data, including the World Bank's Development Indicators,[103] the ITU's World Telecommunication Indicators,[104] the OECD's regional statistics database,[105] and Eurostat's regional statistics database to determine what additional demographic or other factors to include in each community profile.[106] We also looked at studies and national broadband plans from other countries to determine which indicators would reflect the factors typically expected to influence broadband deployment and adoption. Based on our review of these sources, we

[99] Specifically, the statute requires that "[t]he Commission shall choose communities for the comparison under this subsection in a manner that will offer, to the extent possible, communities of a population size, population density, topography, and demographic profile that are comparable to the population size, population density, topography, and demographic profile of the various communities within the United States." BDIA § 103(b)(3); 47 U.S.C. § 1303(b)(3).

[100] *See International Broadband Data Report*, 25 FCC Rcd 11963, 11967-68 (2010); *2011 IBDR*, 26 FCC Rcd at 7387.

[101] There are some differences in the countries included for each dataset contained in this Report. Those differences are primarily due to data availability. *See* Appendix B *infra*. We also recognize that much room for improvement remains with regard to international data availability and collection. *See* Section III.D, *infra*.

[102] 47 U.S.C. § 1303(b)(2)(A).

[103] *See* http://go.worldbank.org/U0FSM7AQ40.

[104] *See* http://www.itu.int/ITU-D/ict/publications/world/world.html.

[105] *See* http://oecd.org/gov/regional/statisticsindicators/explorer/.

[106] *See* http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/introduction.

identified three variables that are particularly likely to be of importance in understanding international broadband service capability and selected them for inclusion in our report: (1) education level within a community (percentage of labor force with tertiary—*i.e.*, college or graduate school—education); (2) total income of a community (GDP, in current U.S. dollars, adjusted for purchasing power parity); and (3) income per capita within a community (GDP per capita, in current U.S. dollars adjusted for purchasing power parity). For this third *IBDR*, we collected data on the same indicators.

37. The data for the variables listed above,[107] are drawn mainly from the OECD's regional statistics[108] and the European Commission's Eurostat regional data.[109] We note that data at the national level for the variables listed above are generally available annually. Community-level information, however, is collected less frequently. Accordingly, we provide the most recent publicly-available data (ranging from 2005-2011) for each variable in the community dataset in Appendix D.[110] Data for communities not covered by the OECD and Eurostat datasets are drawn from national statistical agencies, communications ministries, and communications regulators.[111]

C. Other Relevant Similarities and Differences

38. The BDIA also directs the Commission, for the foreign communities selected, to identify "relevant similarities and differences" across several criteria.[112] For each foreign country included in this *IBDR*, Commission staff collected, in Appendix E, information on topography; the regulatory environment, including national broadband plans; the market structure, including the number of competitors, broadband penetration, and the types of network technologies deployed; types of applications and services used; and other media, specifically television and radio outlets, available to consumers.[113]

D. Goals for Future Reports

39. As discussed above, the BDIA requires that we obtain a wealth of international data, much of which does not exist or is not readily available without significant expense.[114] Though this *IBDR*

[107] *See* Appendix D, *infra*, which contains the most recent data available for the countries surveyed. A more complete version containing historical data going back several years is available at http://www.fcc.gov/reports/international-broadband-data-report-third. Information on topography is included in Appendix E of this *IBDR*. *See* Appendix E.

[108] *See* http://stats.oecd.org.

[109] *See* http://epp.eurostat.ec.europa.eu/portal/page/portal/region_cities/introduction.

[110] Communities that include the capital city of a country are indicated in boldface in Appendix D. Communities that are the same as the capital city are indicated in boldface and italics. For example, Ontario, the Canadian province where Ottawa is located, is in bold, while the District of Columbia is in bold and italics.

[111] *See* "Notes" in Appendix D *infra*.

[112] The statute provides that "[t]he Commission shall identify relevant similarities and differences in each community, including their market structures, the number of competitors, the number of facilities-based providers, the types of technologies deployed by such providers, the applications and services those technologies enable, the regulatory model under which broadband service capability is provided, the types of applications and services used, business and residential use of such services, and other media available to consumers." BDIA § 103(b); 47 U.S.C. § 1303(b). We take "other media" to mean other electronic video and audio news, information, and entertainment options, particularly television and radio. Section 103(b)(2) of the BDIA (47 U.S.C. § 1303(b)(2)) also directs the Commission to identify topography for selected foreign communities.

[113] Much of the information reported in Appendix E of our earlier IBDRs has not changed. Therefore, rather than replicate unchanged information in this report, we incorporate by reference Appendix E from the *2011 IBDR* as supplemented by the new information contained in the new Appendix E herein.

[114] *See* Section II *supra*.

improves upon the *2011 IBDR* in terms of the amount, quality, and analysis of data collected and presented, we aspire to further improve our collection of international broadband data. Obtaining more data (and more granular data) on foreign broadband capability would help us understand broadband deployment and adoption patterns in the United States and globally.

40. Last year, we outlined efforts underway at the OECD to develop meaningful cross-sectional and longitudinal data that can be used to gauge key broadband and Internet-related metrics within and across countries.[115] To further this goal, the Commission hosted a two-day OECD broadband metrics workshop in Washington, D.C. in October 2011, where technical experts from the OECD's Committee for Information, Computer and Communications Policy Working Parties,[116] academics, international institutional stakeholders, and industry representatives examined the OECD's proposed Metrics Checklist and assessed both the broad policy issues and the methodological underpinnings surrounding its further revision, adoption and ultimate implementation.

41. The workshop focused primarily on developing a new metrics and data collection framework to facilitate a harmonized analysis of OECD member economies' broadband infrastructure availability, access, and use, and the impact of the Internet on productivity and other macroeconomic parameters.[117] The major underlying theme of the workshop was the need to standardize terms, benchmarks and indicators, and data collection and reporting tools/methods employed by the OECD and member countries.[118]

42. Ofcom hosted a second workshop in June 2012. Taking into account the outcome of the first metrics workshop in Washington in October 2011, participants met to advance the development of new OECD metrics criteria building on the discussions thus far. In particular, participants at the second technical workshop discussed:[119]

- a new proposed definition of broadband (tiered);
- a subset of meaningful cross-sectional and time-series data that can be implemented quickly and which describes the deployment of broadband services and who adopts them and what services are adopted; and

[115] *2011 IBDR*, 26 FCC Rcd at 7395. The proposal addressed many of the data needs including broadband deployment and adoption data at a disaggregated, statistical, geographic area level, with special attention to residential and business use, speed tiers, the number of competitors, and technology type (*e.g.*, wireline, fixed and mobile wireless). The proposal also called for collection of demographic metrics at a disaggregated, statistical, geographic area level, *e.g.*, education, income, age, and household type. Also part of the proposal was a request for urbanicity metrics, particularly urban versus rural, which could be used as a proxy for loop length. Detailed subscriber price data for OECD countries was part of the proposal as well.

[116] The working parties include the Working Party on Communication Infrastructures and Services Policy (CISP), the Working Party on the Information Economy (WPIE), and the Working Party on Indicators for the Information Society (WPIIS).

[117] For a summary of what transpired at the workshop, *see* http://transition.fcc.gov/ib/Metrics_Workshop/summary.pdf.

[118] *See* OECD Technical Workshop Announcement, "Broadband and Its Impact on Consumers and Economies: Developing a New Framework for Future Metrics" available at http://www.oecd.org/dataoecd/27/1/48594941.pdf.

[119] *See* OECD Workshop on Broadband Metrics, 14-15 June 2012, *available at* http://www.oecd.org/document/7/0,3746,en_21571361_48621988_48622087_1_1_1_1,00.html. *See also* http://stakeholders.ofcom.org.uk/internet/oecd/technical-workshop/ for the papers submitted for discussion at the workshop.

- comparable cross-sectional and time-series data, both qualitative and quantitative, that identifies the drivers of Internet usage and its impact on innovation, productivity and entrepreneurship within and across countries.

43. Subsequently, the outcome of the workshop, including an initial subset of recommended metrics, measuring both broadband and the impact of the Internet Economy, will be submitted to the OECD ICCP Committee for review in fall 2012.[120] The recommendations will be provided to the OECD's Working Parties for their agreement and implementation in December 2012.

IV. CONCLUSION

44. In conjunction with the Commission's adoption of the *Eighth 706 Report*, the release of this *IBDR* fulfills the obligation imposed by Section 103(b) of the Broadband Data Improvement Act.[121]

V. ORDERING CLAUSE

45. IT IS ORDERED that, pursuant to Section 103(b) of the Broadband Data Improvement Act, 47 U.S.C. § 1303(b), and pursuant to authority delegated to the International Bureau in Section 0.261 of the Commission's rules, 47 C.F.R. § 0.261, this *IBDR*, with its associated Appendices A-F, is ADOPTED.

FEDERAL COMMUNICATIONS COMMISSION

Mindel De La Torre
Chief, International Bureau

[120] Video recordings of all the workshop presentations and final papers can be found at http://stakeholders.ofcom.org.uk/internet/oecd/ and http://stakeholders.ofcom.org.uk/internet/oecd/presentations/.

[121] 47 U.S.C. § 1303(b).

APPENDIX A: Countries Included in the *IBDR*

COUNTRIES	Appendix B: Broadband Price Dataset	Appendix D: Demographics Dataset	Appendix E: Market and Regulatory Background	Appendix F: Actual Broadband Speeds
Australia	X	X	X	X
Austria	X	X	X	X
Belgium	X	X	X	X
Bulgaria	X	X	X	X
Canada	X	X	X	X
Chile	X	X	X	X
Cyprus		X	X	
Czech Republic	X	X	X	X
Denmark	X	X	X	X
Estonia	X	X	X	X
Finland	X	X	X	X
France	X	X	X	X
Germany	X	X	X	X
Greece	X	X	X	X
Hong Kong	X		X	X
Hungary	X	X	X	X
Iceland	X	X	X	X
Ireland	X	X	X	X
Israel	X	X	X	X
Italy	X	X	X	X
Japan	X	X	X	X
Korea	X	X	X	X
Latvia		X	X	
Lithuania	X	X	X	X
Luxembourg	X	X	X	X
Mexico	X	X	X	X
Netherlands	X	X	X	X
New Zealand	X		X	X
Norway	X	X	X	X
Poland	X	X	X	X
Portugal	X	X	X	X
Romania		X	X	
Singapore	X		X	X
Slovakia	X	X	X	X
Slovenia	X	X	X	X
Spain	X	X	X	X
Sweden	X	X	X	X
Switzerland	X		X	X
Turkey	X	X	X	X
U.K.	X	X	X	X
USA	X	X		X

APPENDIX B: Broadband Price Dataset

This dataset can be found on the FCC website at http://www.fcc.gov/reports/international-broadband-data-report-third.

Appendix C

International Broadband Prices

Complexity in the pricing of residential broadband services makes any analysis of pricing across countries difficult. The features and quality of broadband service vary across countries and providers; service is often offered under a multi-part pricing scheme,[1] and broadband is frequently purchased as part of a bundle of services.[2] Price comparisons are also difficult because different providers frequently have plans that differ in various components of "price." For example, it is not simple to compare an offering of unlimited broadband service with a maximum download speed of 5 Mbps for an up-front fee, a flat monthly recurring fee, and a two-year contract with an early termination fee, to a 5 Mbps offering from another provider that charges a different up-front fee, monthly recurring fees that vary with usage, and the ability to cancel service at any point with no penalty or termination fee. In addition, broadband offerings around the world vary with respect to download and upload speeds; limitations on use, including limits on upload and download volumes; determinations of usage limits (download traffic vs. a combination of upload and download traffic vs. download traffic at peak/non-peak usage times); and consequences of exceeding usage limits (*e.g.*, access speed reductions, surcharges, service cut-off). Price offerings can also vary based on the level of involvement of a government in a country's broadband deployment, through the use of taxes and subsidies. Identifying the price of broadband becomes even more complicated when broadband is bundled with other services, such as telephone or video service. And promotional offers further complicate comparisons. Additionally, data on subscribership is not available at the plan level, and any average price comparison implicitly assumes uniform subscribership of all plans.

Notwithstanding these inherent difficulties, this Appendix provides a best-effort report on available fixed and wireless broadband plans for all OECD countries,[3] the quality attributes of each plan, the advertised and promotional prices, and non-recurring charges associated with each plan. We analyze this data in sections 1 (for fixed broadband) and 3 (for mobile broadband). In section 2, we use data provided by Ookla to compare countries based on speed-adjusted prices for fixed broadband.

I. Data on Residential Fixed Broadband Prices

[1] For example, broadband service price often includes an installation charge, a monthly service fee, and possibly equipment rental charges.

[2] *See, e.g.*, Scott Wallsten, Understanding International Broadband Comparisons: 2009 Update (Technology Policy Institute Paper, June 2009), *available at* http://ssrn.com/abstract=1434570 (discussing difficulties in comparing broadband prices due to differing characteristics of broadband services and the tendency of consumers to purchase services in bundles).

[3] Staff gathered data on the most popular offerings if they were identified as such on the provider's website. If the website did not indicate which plans were most popular, we obtained data for all offers advertised. To the extent possible, we tried to capture the same plans that OECD used in its 2010 study of popular broadband offers and prices; however, not all of those plans from 2010 were still being offered in 2011. *See* Table 7.19. Broadband pricing for residential users in the OECD area, September 2010, http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html.

Commission's Web Harvest Data

In compliance with the BDIA's directive that we compare, among other metrics, price information in 75 communities in at least 25 countries.[4] Commission staff has compiled a dataset of publicly available advertised pricing information for residential broadband services in 38 countries (including the United States), most of which are members of the OECD. Our research this year generated a much richer dataset than the one included in the previous *IBDR*. The dataset includes 1671[5] residential post-paid broadband offers by all major Internet service providers for these 38 countries,[6] including 113 U.S. plans. Staff collected this pricing information between August 2011 and December 2011.[7] The countries in the dataset represent a broad range of broadband markets, including countries of various sizes and population densities from every continent except Africa and Antarctica. The economies of the countries we examined range from emerging economies such as former Soviet republics and Mexico, to mature economies such as Germany and Japan.

The dataset includes information on advertised monthly recurring charges and nonrecurring charges, such as connection and modem fees, to allow for a more complete pricing analysis of each broadband Internet service offering. It also includes promotional discounts and rebates such as those associated with online sign-up and longer service contracts, and the duration of those promotions. Information on incidental and recurring costs (such as installation and equipment rental fees), and other charges is also included.

For each broadband service offering, the dataset includes upload and download speeds,[8] limitations on data usage, and information on the types of technology offered. In the dataset there are 192 symmetric DSL plans, 386 ADSL plans, 128 VDSL plans, 351 cable plans, 463 fiber plans, 51 DSL-cable plans, 22 DSL-fiber hybrid plans, 60 cable-fiber hybrid plans, and 18 satellite plans.[9] Appendix Table 1a

[4] BDIA § 103(b); 47 U.S.C. § 1303(b).

[5] The raw data that was collected had 1732 plans. However for some plans either the monthly charges or some other information was missing so the final cleaned dataset has 1671 plans.

[6] For each of the European countries in the dataset, we obtained a list of incumbent operators and their competitors from the European Commission's 2010 report on broadband Internet access prices. *See Broadband Internet Access Cost (BIAC)*, Final Report, prepared for the European Commission, Information Society and Media Directorate-General, by Van Dijk Management Consultants, January 2010, Brussels, Belgium, *available at* http://ec.europa.eu/information_society/eeurope/i2010/docs/benchmarking/eda/biac_2009.pdf. This was supplemented with staff research into incumbent operators and their competitors, for both European and non-European countries.

[7] We assembled the data by visiting the websites of broadband providers serving the countries and communities in our sample. In order to mitigate the effects of variations in a particular broadband provider's prices over time, we visited the websites of providers and downloaded the relevant information at one specific point in time. Thus, data was collected between October 2011 and December 2011. Our price data reflects only what a given provider was offering at the specific point in time we accessed its website. For some countries in the dataset, we were able to determine whether the offerings were on a national or community level. Many advertised offerings were national in scope, though some were listed for particular cities or on an "as available" basis. Because we obtained the information for the dataset at specific points in time, we were not able to determine which offers are regularly available and which are significant departures from regularly available offers. Therefore, while ideally we would include only widely and regularly available offerings, it is possible we captured information on some non-standard offers such as special, promotional, or other limited offers.

[8] In some cases, providers did not indicate upload speeds on their websites. *See* Appendix C.

[9] The DSL, ADSL and VDSL categories include DSL, ADSL, ADSL2+, VDSL, VDSL2, XDSL, SHDSL, DSLD, LAN, XDSL & SIOL Telephony; cable includes regular cable and the upgraded Docsis3 technology; Fiber includes, regular fiber, FTTH and NGN; the Cable-DSL hybrid includes some combination of ADSL or

shows the number of plans for each country, disaggregated by the type of broadband bundle. Additionally, the usage limits on each plan and the consequences of reaching that usage limit are reported, such as the extra charge customers may incur, or whether they experience a slowdown of their speeds.

The dataset also shows the bundling characteristics of the plans. Service bundles can have a wide assortment of components, and variations in broadband plans bundled with other services present additional layers of complexity. The *2011 IBDR* had listed whether the bundles were double, triple or quad play, without listing the bundle elements. While this is useful in understanding the differences in pricing, it does not capture the full extent of the variations because the bundle components are unknown. For example, a double play bundle that has broadband and video will be priced very differently from a bundle that has broadband and phone service. Without this information, interpreting pricing differences across countries is problematic. The 2012 *IBDR* price comparison corrects this shortcoming by listing the bundle components. The dataset shows whether the offer is a standalone broadband plan, or whether it includes bundled services such as voice, wireless, WiFi or video. Data on the number of video channels included in a video bundle, or the type of TV service (basic, premium and so on), and the number of phone minutes included in phone packages are included wherever available. This allows us to analyze price differences more rigorously.

Computing Monthly Net Price Across Countries

To compare prices across countries, first, we need to construct an annual or monthly price that reflects all the rebates, charges and fees associated with each plan. Thus, this price reflects all the recurring and non-recurring charges of a plan. To accomplish this, we first estimate the total amount that the customer pays over the life of the contract[10] using the formula below.[11]

> Net price for the contract term = (promotional price * number of months promotion lasts) + (standard price * (contract term – number of months promotion lasts)) + installation fee + activation fee + equipment charges + modem rental charge + other fees (incl. line charges) – rebates.

VDSL with cable; the fiber-DSL hybrid includes some combination of fiber with VDSL or XDSL; Cable-fiber hybrid includes some combination of a cable and fiber, or a hybrid fiber coaxial network. Some plans did not list some characteristics and were dropped from the final dataset of 1671 total plans.

[10] An alternative approach would be to calculate the first year annual cost to the customer. However, this may bias the resulting price variable as some of the one-time rebates will be deducted for the 12 month cost, rather than over the entire contract period, which is usually 18 months or more. This will bias the prices downward. Conversely, installation charges and other one-time fees will be added to the 12 month period rather than being spread out over the longer contract period. This will bias prices upwards. To avoid such biases we calculate the contract length cost to the customer and then calculate the monthly cost by dividing it by the length of the contract. Although this is the best price measure, some biases remain. In particular, the contract period pricing may have a downward bias if prices revert to "full rack rate" and people pay that after the contract period. Or the bias maybe upward if save-desk prices are lower than advertised. However, without detailed data on the average revenue per user in ever plan category for every provider in every country, the contract length price calculation is the appropriate method for calculating prices.

[11] This is a modified version of the one year formula used by Scott Wallsten in his paper "Residential and Business Broadband Prices Part 1: An Empirical Analysis of Metering and Other Price Determinants", available at http://works.bepress.com/cgi/viewcontent.cgi?article=1109&context=scott_wallsten.

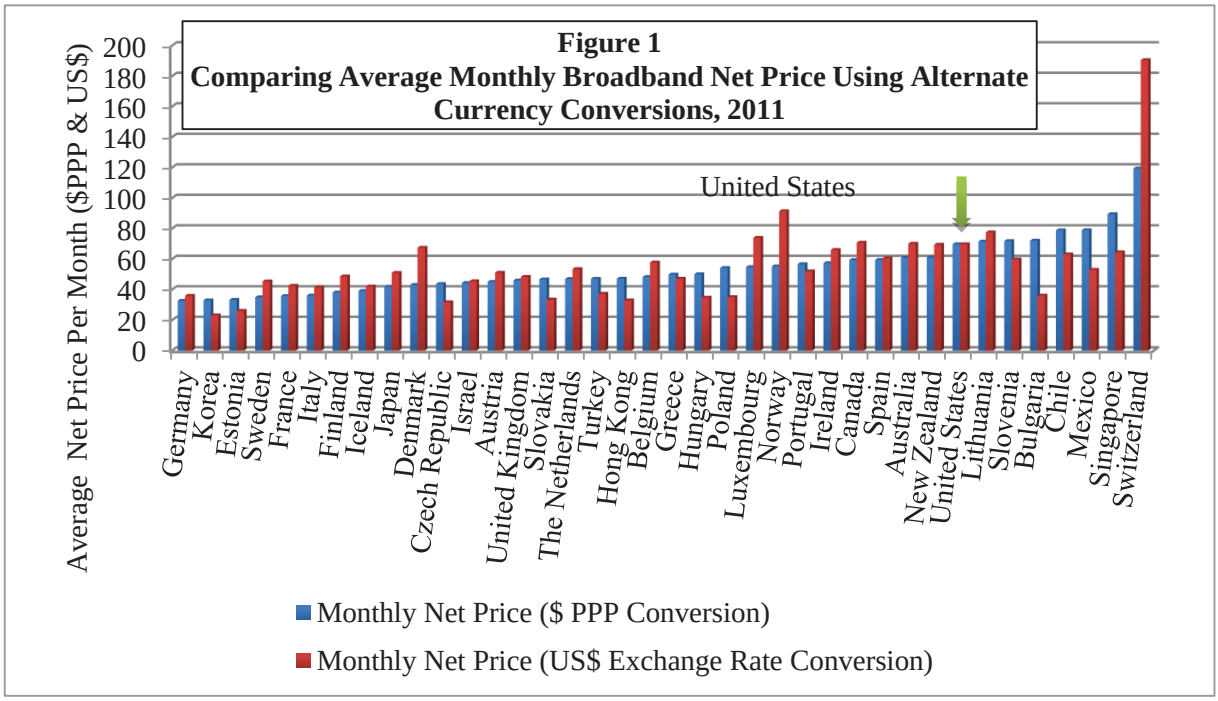
We then calculate the monthly net price by dividing it by the length of the contract. Next, we convert all prices to U.S. dollars based on both current exchange rates[12] and purchasing power parity (PPP).[13] We use both approaches since each methodology has its pros and cons.[14] When computing the country price, we compute the simple average of all the prices as subscribership data at the plan level is unavailable. Thus caution must be taken when interpreting these price comparisons.

Figure 1 (Appendix Table 1b) shows the monthly net price data for both the PPP and exchange rate conversions. This price is a simple average price over all plans in the sample for each country and does not correct for any quality attributes such as bundling characteristics, speed, or usage limits.

[12] Exchange rates fluctuate on a daily basis. The exchange rates (2010) and PPP conversion factors (2011) we used for each country are annual rates and factors obtained from the International Monetary Fund, World Economic Outlook Database, September 2011.

[13] PPPs are currency conversion rates that convert to a common currency and equalize the purchasing power of different currencies. In other words, they eliminate the differences in price levels between countries in the process of conversion. PPPs show the ratio of the prices in national currencies of the same good or service in different countries. For example, if the price of a hamburger in France is €2.84 and the price of an equivalent hamburger in the United States is $2.20, then the PPP for a hamburger between France and the United States is €2.84 to $2.20, or €1.29 to the dollar. This means that for every dollar spent on hamburgers in the United States, €1.29 would have to be spent in France to obtain the same quantity and quality of hamburgers. *See* OECD, Statistics Directorate webpage, *available at* http://oecd.org/department/0,3355,en_2649_34357_1_1_1_1_1,00.html and FAQ webpage, *available at* http://oecd.org/faq/0,3433,en_2649_34357_1799281_1_1_1_1,00.html#1799063. The *2011 IBDR* reports (Footnote 61) that AT&T contends that since PPP does not measure the actual cost of broadband service but rather its cost relative to the cost of living, the use of PPP gives EU countries a 21-28% discount compared to the United States. The PPP conversion is an accepted method of equalizing purchasing power in different countries, thereby enhancing comparative studies. Tim Callen, *PPP Versus the Market: Which Weight Matters?*, Finance and Development, Vol. 44, no. 1, March 2007 International Monetary Fund, *available at* http://www.imf.org/external/pubs/ft/fandd/2007/03/basics.htm. It accurately reflects the cost of a product or service relative to other items in a particular country and can allow a more valuable international comparison than merely comparing prices based on exchange rates in certain circumstances. International exchange rates, unadjusted for purchasing power, are most relevant when goods and services are traded across international borders. Generally, non-traded services or products are cheaper in less affluent countries than in more affluent countries because of lower wages and income to afford these services. This can vary, though, depending on how much the service makes use of goods that are traded across international borders. Failure to account for such differences may understate the cost of those services, relative to the economy, in less affluent countries. Nonetheless, we have also included in Appendix C the data using current exchange rates to provide an additional perspective. We believe that use of the exchange rates, unadjusted for purchasing power, provides a nominal measure of broadband service prices across countries, while the use of the PPP conversion factor not only converts the local currencies to a common currency but also measures value of broadband services at a uniform price level. *Id*.

[14] See Rodney L. Ludema, "Nominal Prices, Real Prices and Faux Prices: The Perils of Comparing Individual Prices at Purchasing Power Parity Exchange Rates" (2010). http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1575745



Note: The monthly net price reflects the price per month, including rebates, installation charges, equipment charges such as modem rentals and other fees. So the net price is different from the simple monthly advertised price.

Generally, we find that Germany, Korea, Sweden and Estonia have some of the lowest monthly broadband prices, and Singapore, Mexico and Switzerland have the highest prices for the PPP conversion. The United States appears to be one of the high priced countries with an average price of $69.75 per month.[15]

It would be inaccurate however, to perform an international comparison of prices based solely on average net prices. Usage limits, speeds, and bundling characteristics on plans differ considerably among countries, and average price alone is not meaningful as it conflates the price of different types of plans into one price. Thus, comparisons should be done based on usage limits, *i.e.* price per gigabyte (GB) of data included in the plan, or prices in narrowly defined speed tiers. Below, we discuss both metrics.

Comparing Standalone Broadband Net Prices by Speed (1-25 Mbps) and Technology

Prices for different broadband service tiers vary widely. In the United States, the cheapest plan in our sample is $23 per month with 768 Kbps download speed and unlimited data, while the most expensive naked broadband plan in the sample[16] is a FiOS fiber plan at $199 per month with 150 Mbps of download speed, 35 Mbps of upload speed and unlimited data. In this section we compare countries based on the average advertised monthly net price of standalone broadband plans, comparing only

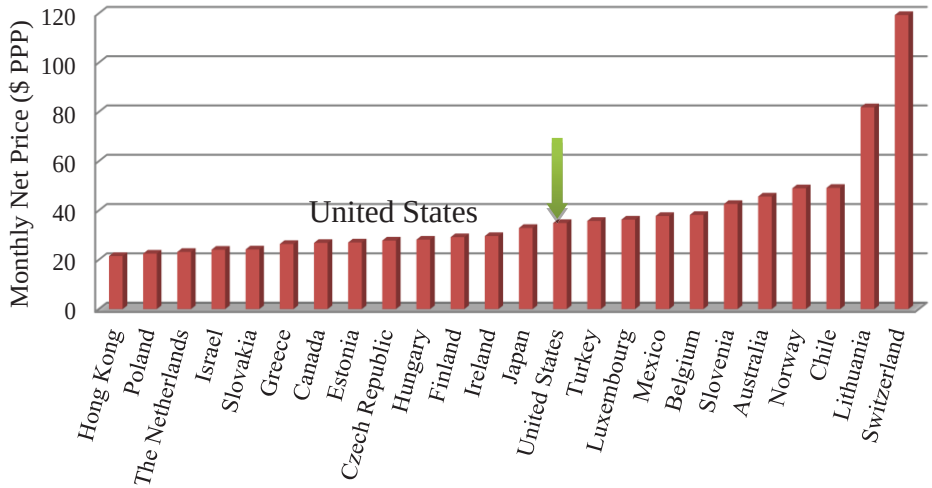
[15] This price is a simple average of all the U.S. plans (standalone and bundled broadband) in the dataset.

[16] FiOS has recently come out with a 300 Mbps broadband plan for $209.99.
Source: (http://www22.verizon.com/home/fios-fastest-internet/fastest-internet-plans/)

comparable speed tiers. We focus on speed tiers in the 1-25 Mbps range since 86% of U.S. broadband consumers[17] subscribed to services in this range in 2011.

We caution that our comparisons are based on advertised speed,[18] *i.e.* the maximum theoretical speed that the consumer could achieve with a given broadband connection, and not what the consumer will actually get. To the extent that advertised speeds overstate actual speeds by less in the United States than in most other countries, comparing advertised speeds will disfavor the United States. We discuss this possibility in greater detail in the next section.

Figure 2a
Average Monthly Net Price ($ PPP) of Residental (Fixed) Standalone Broadband 2011
1-5 Mbps of Download Speed



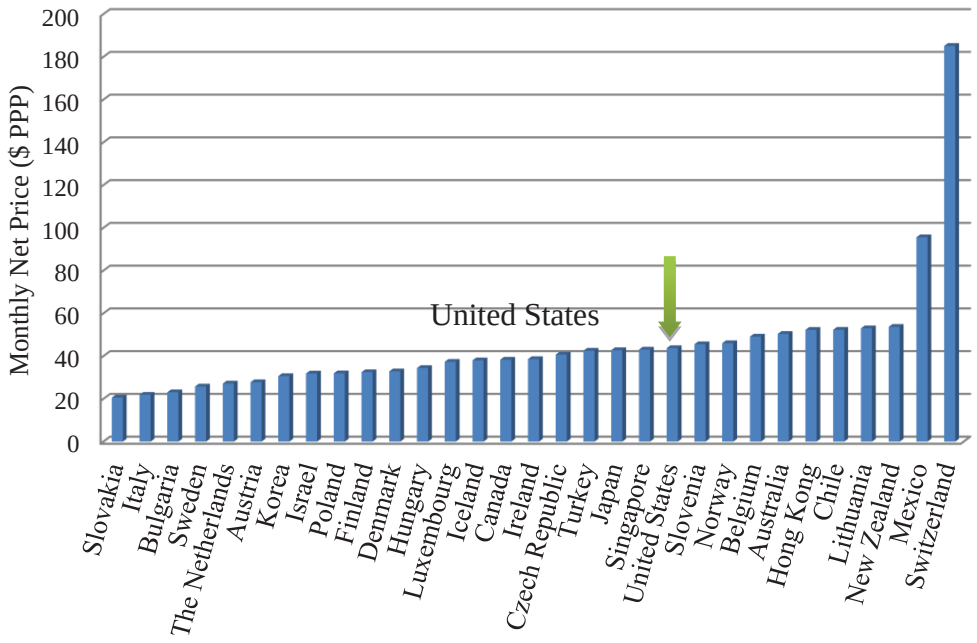
Note: The monthly net price reflects the price per month, including rebates, installation charges, equipment charges such as modem rentals and other fees, which is different from the simple monthly advertised price. The average price is obtained by a simple average over all technologies, excluding satellite, in the 1 – 5 Mbps speed tier. Austria, Denmark, France, Iceland, Italy, Korea, New Zealand, Singapore, Spain, Sweden and the United Kingdom do not have any standalone broadband plans in the 1-5 Mbps speed tier in our sample. Portugal and Germany only have satellite plans for that speed tier. Thus all are excluded from Figure 2a.

[17] We compute this using subscription data from the FCC's 477 report that collects the number of residential and business lines in eight speed buckets. The percentage of subscribers in the 1-25 Mbps speed tier is the proportion of subscribers in the 1.5-25 Mbps speed tiers and half the subscribers in the 768 Kbps-1.5 Mbps speed tier.

[18] See discussion of the "shortfall index" or the percentage difference between advertised and actual speed in Appendix F (Figure 1B).

Appendix Table 2a-2c and Figure 2a-2c compares the average monthly net price[19] of standalone broadband in the 1-5 Mbps, 5-15 Mbps and 15-25 Mbps download speed tiers. Figure 2a shows that the United States is 14th out of 24 countries within the 1-5 Mbps speed tier, with an average price of $34.93 and an average download speed of 2.78 Mbps (when satellite is excluded). The two lowest price countries are Hong Kong and Poland with an average net price of approximately $22. These countries also report a lower average download speed, however, of 1.65 Mbps. The two highest price countries are Lithuania and Switzerland with net prices of $81.90 and $119.33 respectively. Appendix Table 2a suggests that a majority of the standalone plans at the 1-5 Mbps speed tier are DSL plans. Out of the 19 countries that have DSL plans, the United States is the 7th lowest in price with an average net price of $34 per month. U.S. cable prices are the most expensive in this speed tier with an average of $42.30 (standalone broadband). The lowest cable price in this speed tier is $16.70 in Poland. The United States also has satellite plans in this category with an average price of $84.32. Germany and Portugal were the only other countries with satellite plans in this speed tier. See Appendix Table 2a.

Figure 2b
Average Monthly Net Price ($ PPP) of Residental (Fixed) Standalone Broadband 2011
5-15 Mbps of Download Speed

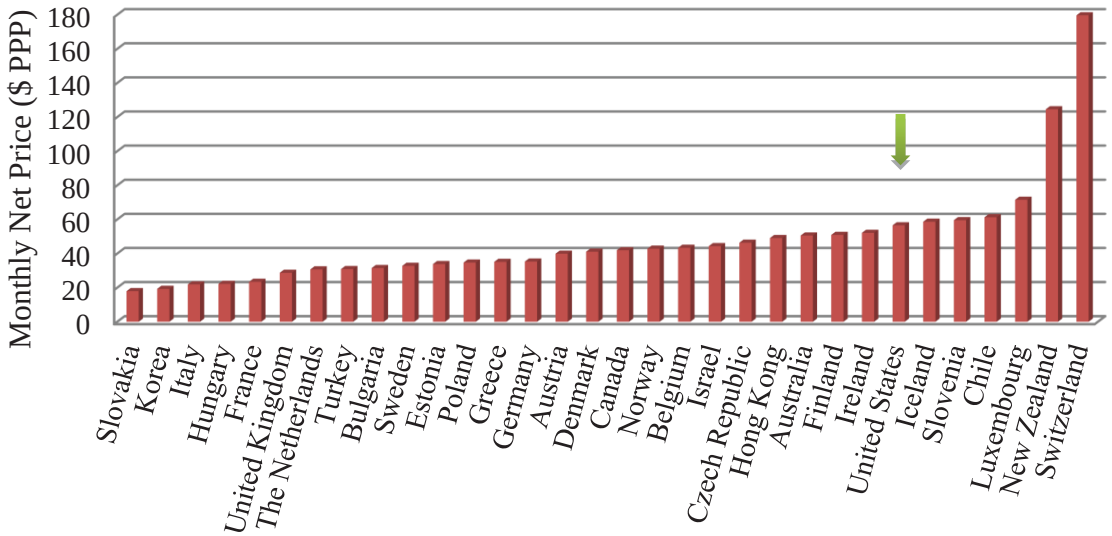


Note: The monthly net price reflects the price per month, including rebates, installation charges, equipment charges such as modem rentals and other fees. The net price is different from the simple monthly advertised price. The average price is obtained by a simple average over all technologies, excluding satellite, in the 5-15 Mbps speed tier. In our sample, Estonia, France, Germany, Greece, Spain, and the United Kingdom do not have any standalone broadband plans in the 5-15 Mbps speed tier; Portugal only has satellite plans for this speed tier in our sample, and is thus excluded from this graph.

[19] Spain has no standalone broadband plans in any speed-tier in the *IBDR* sample. Other countries, such as Austria, Denmark, France, Iceland, Italy, Korea, New Zealand, Singapore, Spain, Sweden and the United Kingdom, do not have standalone plans in all speed-tiers.

Figure 2b shows average prices in the 5-15 Mbps speed tier (again excluding satellite services). The United States is 21st out of 31 countries with an average price of $43.71 and an average download speed of 10.72 Mbps. The two lowest price countries are Slovakia and Italy with an average net price of approximately $21. These countries report average download speed of 10 Mbps. The two highest price countries are Mexico and Switzerland with net prices of $95.60 and $185 respectively. Appendix Table 2b shows the breakdown by technology in this speed tier. The United States is 9th amid 24 countries having DSL plans, with an average net price of $40.80 per month. The lowest average price is in Sweden ($25.30) and the highest is in Switzerland ($185). The United States cable and fiber plans average $44.75 and $54.99 respectively. See Appendix Table 2b for prices in other countries.

Figure 2c
Average Monthly Net Price ($ PPP) of Residental (Fixed) Standalone Broadband 2011
15-25 Mbps of Download Speed



Note: The monthly net price reflects the price per month, including rebates, installation charges, equipment charges such as modem rentals and other fees. So this is different from the simple monthly advertised price. The average price is obtained by a simple average over all technologies, excluding satellite, in the 15-25 Mbps peed tier. Lithuania, Mexico, Portugal and Spain, do not have any standalone broadband plans in this speed tier in our sample, and are thus excluded from the graph.

Figure 2c shows average prices in the 15-25 Mbps speed tier (again excluding satellite services). The United States is 26th out of 32 countries with an average price of $56.50. The two lowest price countries are Slovakia and Korea with an average net price of approximately $18-19 and average download speeds of 20-25 Mbps. The two highest price countries are New Zealand and Switzerland with net prices of $124.50 and $180 respectively. Appendix Table 2c shows the technology breakdown. The United States is 15th among 25 countries having DSL plans, with and average net price of $49 per month. The lowest average DSL price is in Italy ($22) and the highest is in Switzerland ($242.90). The United States is among the more expensive in terms of cable and fiber.

Overall, prices in the United States fall in the middle among surveyed countries in the 1-15 Mbps speed range and in the upper 75th percentile in the 15-25 Mbps range. In speed tiers above 25 Mbps, the United States is also one of the more expensive countries as well.

Double Play Broadband Net Prices by Bundle Type (1-25 Mbps)

Double play bundles can comprise broadband and phone, broadband and video and Double play bundles can comprise broadband and phone, broadband and video and broadband and wireless bundles. The features, speeds and prices of these bundles vary significantly and the appropriate comparison is thus between similar bundle types. The two major category of double play bundles are broadband and video and broadband and phone. The most common double play bundle is a broadband and phone bundle (29 countries), followed by the broadband and video bundle (16 countries).[20] Only seven countries have broadband and wireless bundles in our sample.

With the data we have, a meaningful comparison of video double play bundles across countries is impossible. The composition of video channels and the associated content cost differ widely between countries. Generally speaking, in the United States, the typical video package includes more premier channels with higher content cost. For example, in our dataset the FiOS double play video plan, with 15 Mbps download speed and 5 Mbps upload speed, has more than 210 channels including more than 55 HD channels, premium channels such as ESPN and Discover, extensive On Demand library with over 35,000 titles many of which are free, and 46 commercial-free music channels. In comparison, a similar broadband plan in the United Kingdom offers 16 Mbps download speed along with 70 free preview channels and "catch-up" TV.[21] Content costs in the United States are very high compared to other countries. We estimate that the cost of video content in the United States is $42.70 per subscriber per month on average.[22] In contrast, adding or removing 150 video channels to a broadband product in France does not change the monthly charge and in most European countries, adding video to a broadband service changes the price generally between five to ten Euros a month.[23] This makes it impossible to meaningfully compare bundles that contain video services.

Double play bundles that include a phone service along with the broadband service allow for better comparisons. Even this comparison poses challenges, however. In particular, we must control the number of local and long distance minutes. Many phone double play plans in the United States have unlimited local and long distance calling within the United States, while most plans in other countries have limited minutes. To address these issues, in Figure 3, we compare DSL double play phone plans in the 1-25 Mbps download speed tier,[24] including only those plans with unlimited local and long distance calling. See Appendix Table 3a for the data.

[20] There are 14 countries in Appendix Table 3c as Korea and Canada have no double play plans in the 1-25 Mbps speed tier in the sample.

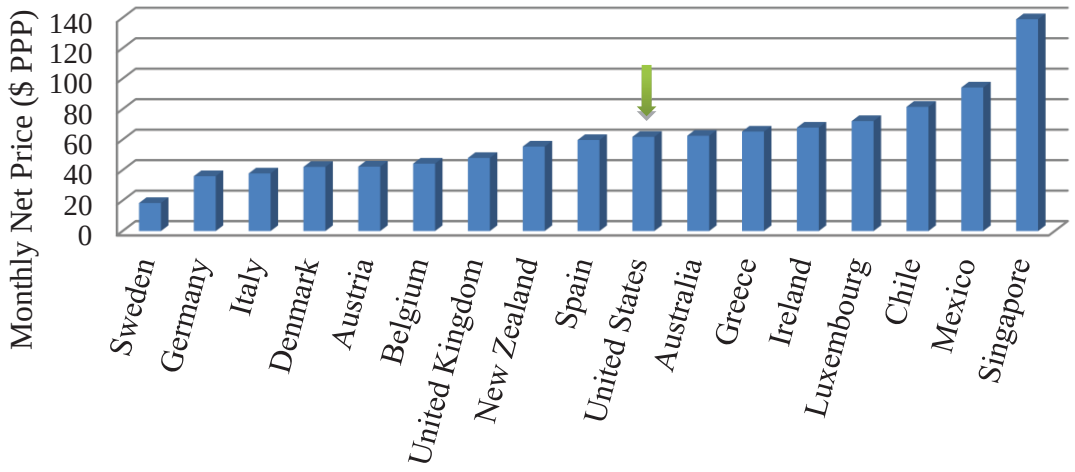
[21] The "TV Essential" plan by BT TV allows a subscriber to add this basic TV package for 4 pounds per month if they already have the broadband.

[22] This is estimated as the sum of the affiliate fees for all cable channels listed on SNL Kagan and 50 cents for the retransmission consent fees for each of the four major broadcast networks.

[23] See http://abonnez-vous.orange.fr/residentiel/forfaits/livebox-star.aspx.

[24] This sample is also restricted to plans that have less than 20 Mbps of upload speed.

Figure 3
Average Monthly Net Price ($ PPP) of Residental (Fixed) Phone and Broadband Bundle with Unlimited Local and Long Distance calling Minutes, 2011
1-25 Mbps of Download Speed



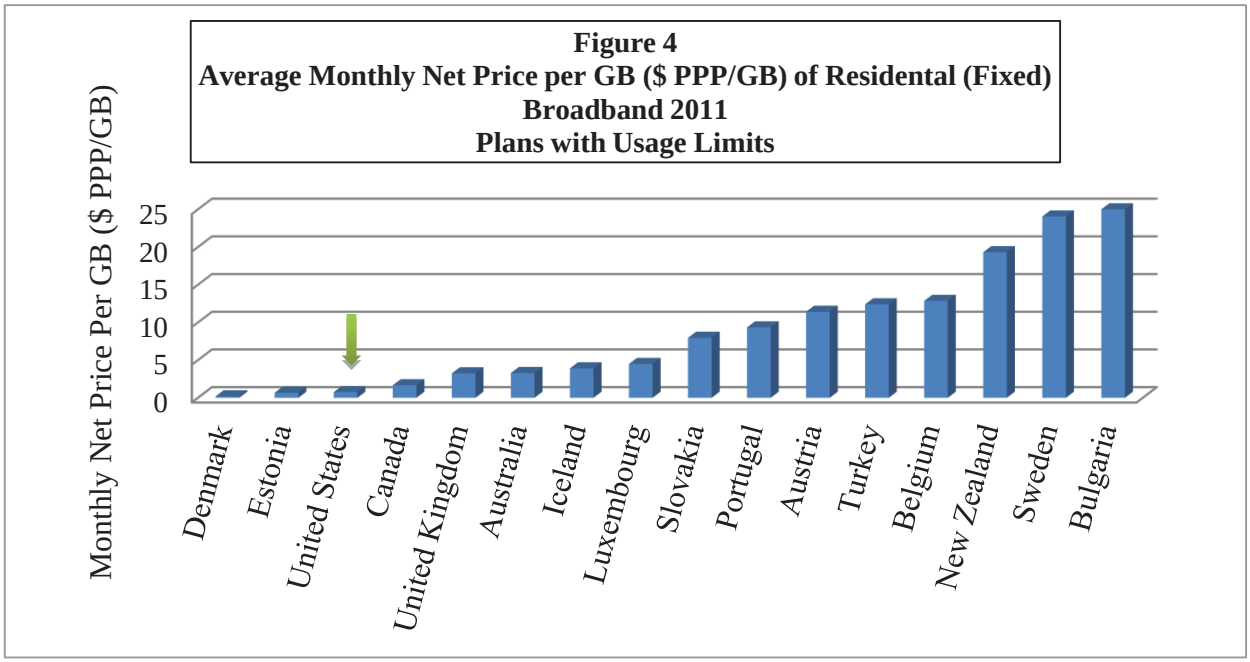
We find that the United States is 10th among 17 countries having phone double play bundles with unlimited local and long distance minutes, with an average price of $61.80. The least expensive country is Sweden ($18.40) and the most expensive is Singapore ($139). The data for all video and phone double play plans by speed-tier are presented in Appendix Tables 3b-3c. The data for the triple play plans (broadband, video and phone) by speed tier are presented in Appendix Table 3d. We did not do a further analysis of the data due to the lack of comparability in the plans when video is included in the bundles. The above discussion shows how complex the price data are and the challenges with international comparisons. Thus further analysis that appropriately controls for the characteristics of the plans, such as usage limits and advertised speed, is required to understand where the United States stands in terms of the quality-adjusted price of broadband.[25]

[25] If detailed disaggregated data were available for all plan characteristics across countries, the most appropriate price comparison would be based on a hedonic price index that is constructed from a hedonic regression analysis. However, due to the unavailability of some important price attributes such as the number of channels included in video, the quality-adjusted prices obtained from a hedonic regression based on current data may not be appropriate. Thus, we do not present the quality-adjusted price results in the report. In brief, a hedonic regression approach decomposes a product into its attributes, and then obtains estimates of the value of each attribute in the overall product. This assumes that the product is a sum of its characteristics and that the market can value those characteristics. For example, in our case, the price (or value) of a broadband plan can be decomposed into how much speed the plan promises to deliver, the usage limits on the plan, the consequence of exceeding the usage limit, the bundle characteristics, such as whether video is included or not, and so on. Presumably, the sum of the value to the consumer of each of these attributes leads to the composite price. Hedonic models are commonly used in constructing the Consumer Price Index, and are usually estimated using regression analysis. Comparing this price index, rather than raw average prices, allows for a more valid comparison of the "average" broadband price in each country. We conducted a hedonic regression analysis to model prices as a function of speed, technology type, usage limits associated with each plan, consequence of that usage limit (speed slow down versus additional charge), contract length, and characteristics of the bundle (double, triple or quad play, including the bundle components) if the broadband plan is part of a bundle and country fixed effects. We found that the U.S.

Comparing Monthly Broadband Net Price per GB

Next, we compare countries based on the price per gigabyte of data that is included in the usage limit, and does not control for difference in speed or other bundle characteristics. Consequently, we base the comparison on plans that have a specified usage limit. In our sample, 16 countries have such plans. Figure 4 (Appendix Table 4a) presents the results; the United States ranks 3rd out of the 16 countries with an average monthly price of $0.76/GB. Denmark appears to be the cheapest, with an average monthly price of $0.02/GB, and Bulgaria is the most expensive at $25.77/GB. From Appendix C Table 4a and b, it appears that "light users" of broadband, who can remain within the imposed usage limits, fare better in the United States compared to most other countries. "Heavy users," *i.e.* those that may require unlimited plans, would fare better in countries such as Sweden, Estonia and Germany.

Figure 4
Average Monthly Net Price per GB ($ PPP/GB) of Residental (Fixed) Broadband 2011
Plans with Usage Limits



Note: This comparison is based on plans that have hard usage limits in all speed tiers, all technologies and both standalone and bundled plans.

The above analysis shows how country rankings can change considerably when plan characteristics, such as usage limits, are taken into account. It demonstrates how complex the price data is and the difficulty in making international comparisons. Thus, further analysis that appropriately controls for

quality adjusted prices were lower than the simple average prices we obtained from the raw data. For additional literature about hedonic regressions, *see* Rosen, S., "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," Journal of Political Economy, January-February 1974, pp. 34-55; Greenstein, S., and McDevitt, R., "Evidence of a Modest Price Decline in US Broadband Services," The Center for the Study of Industrial Organization, Northwestern University, Working Paper #0102 (2010); Stranger, G., and Greenstein, S., "Pricing at the On-ramp to the Internet Price Indices for ISPs during the 1990s" (2008), in Hard to Measure Goods and Service: Essays in Memory of Zvi Griliches, edited by Ernst Berndt and Charles Hulten, University of Chicago Press; Williams, B., "A Hedonic Model for Internet Access Service in the Consumer Price Index," Monthly Labor Review, July 2008, pp. 33-48.

the characteristics of the plans, such as usage limits, advertised speed, and bundling, is required to understand where the United States stands in terms of quality-adjusted price of broadband.

II. Speed-Adjusted Prices

As the earlier discussion suggests, advertised speeds may not equate to the speeds consumers actually receive, and the gap between advertised and actual speeds may differ between countries. Given this, an additional useful metric when comparing the affordability of broadband across countries is a measure of actual speed adjusted price, *i.e.* price per Mbps of actual measured speed. Ookla's "Value Index" data (which is a sub-section of the Net Index data) reports the daily median price per Mbps[26] in 848 cities around the world. In contrast to our web scraped data, the Ookla data also has the advantage that all reported speeds are for actual plans with subscribers, and the number of reports may roughly correspond to the share of various speed plans across different countries.

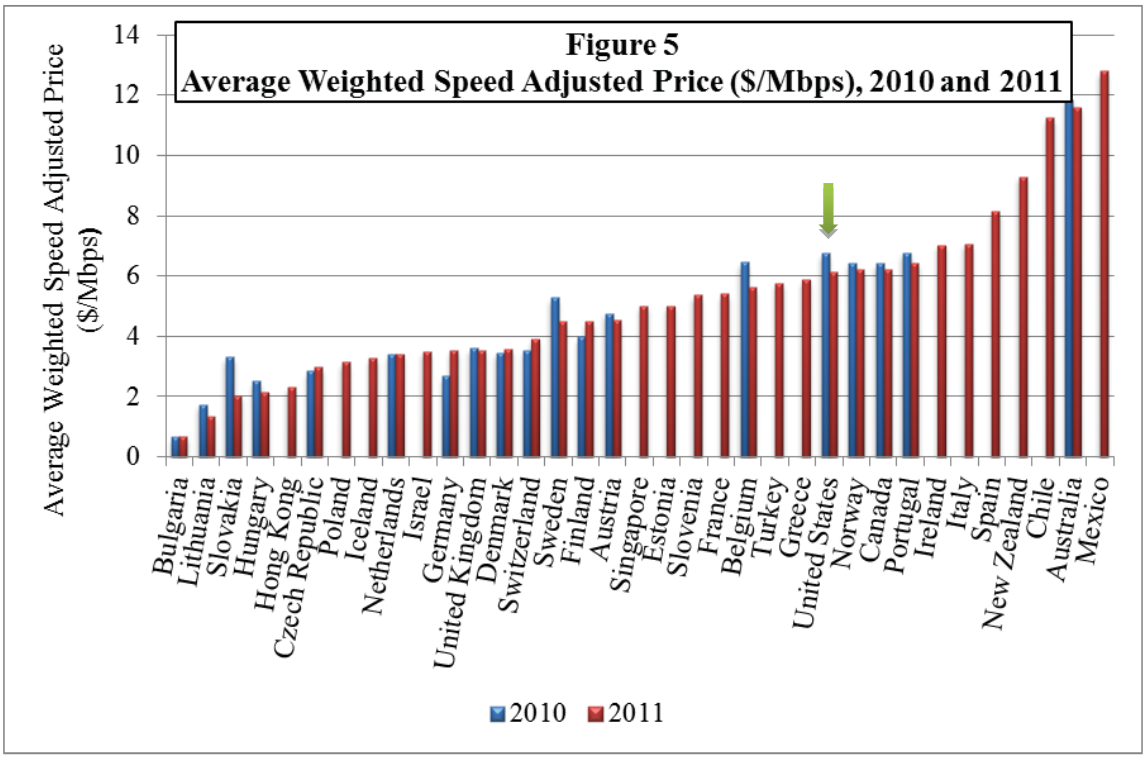
While Ookla data is the best available for international prices based on actual speeds, some caveats have to be noted when interpreting this data. First, the prices reported in Ookla are derived from surveys that are administered to people who take the speed test and are therefore subject to misreporting. Second, when asked about the price of a broadband plan, consumers may report the recurring monthly charges and exclude non-recurring charges such as installation fees. Thus, if there are some countries with high non-recurring costs, this variation will not be captured in the Ookla price data. Third, we do not know whether the reported prices are for standalone broadband or broadband purchased as part of a bundle, nor do we have information on non-speed plan attributes like monthly usage limits. Thus, we cannot disaggregate by the bundling characteristics or usage limits, as we did earlier, but only compare average prices.

Figure 5 shows the average weighted price (U.S. dollars) per Mbps[27] of download speed for consumers, for 2010 and 2011.[28] Bulgaria, Lithuania, Slovakia, Hungary and Hong Kong pay the lowest amount per unit of speed, while New Zealand, Australia, Chile and Mexico are the most expensive. The price per Mbps appears to have increased in Switzerland and Finland from 2010 to 2011. We find that although the United States is not among the least expensive countries, the price per Mbps noticeably declined from 2010 to 2011. Appendix C Table 5 has the data.

[26] One potential bias from this metric is that more expensive plans (e.g., $100+ for 100 Mbps) may look cheaper than lower-price plans. That also means that to the extent the U.S. has a bias toward lower-speed plans and slow speed DSL plans relative to other countries, this figure will also show a bias toward higher prices.

[27] The Ookla data reports the median price per Mbps on a daily basis for each city in its data set. We calculate the average of these prices.

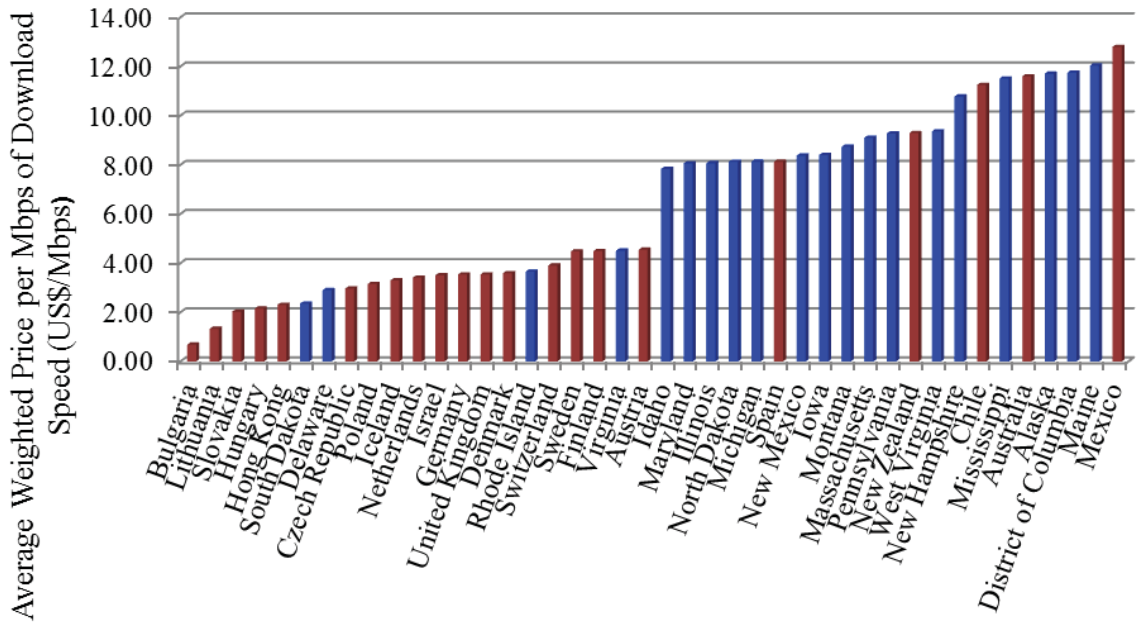
[28] The Net Index price data does not include Japan or South Korea.



Source: Based on the Value Index data from the Ookla Net Index database. The price per Mbps is weighted by the sample size for each city when constructing the country average. Japan, the Netherlands and South Korea are not in this dataset.

The data presented in the above graph provides a snapshot of the trends in speed adjusted price by comparing country-level data from 2010 and 2011. However, there is significant heterogeneity among U.S. states. Additionally, the 2010 data is sparse and does not have as extensive coverage as the 2011 data. Therefore, in Figure 6, we show the weighted average price per Mbps for the top and bottom 25th percentile of countries and U.S. states for 2011. We find that South Dakota, Delaware, Rhode Island, and Virginia are among the states with the lowest price per Mbps. In contrast, Mississippi, Maine, Alaska, and Washington D.C. are on the top end of the price distribution. The data for all the countries and U.S. States is shown in Appendix C Table 6.

Figure 6
Average Weighted Speed Adjusted Price 2011
Top and Bottom 25th Percentile



Source: Value Index from the Ookla Net Index database provided by Ookla. Japan, the Netherlands and South Korea are not in this dataset. The blue bars denote U.S. states.

As noted above, the disparity in speed-adjusted priced across the United States may be the result of sample errors or differences in broadband adoption patterns considered above. Additionally, these rankings do not control for the type of cities generating the data. For example, from existing literature, we know that population level and/or density is directly related to availability and costs of broadband.[29] The rankings further illustrate the difficulty in comparing the data and the need for further, careful analysis of the speed-adjusted price data. Controlling for population metrics will be considered for future reports.

III. Mobile Broadband Prices

The price data for mobile broadband plans are complex, and every country has different reporting and advertising standards. Usage limits, differing peak and off-peak speeds, all effect price comparisons. For example, advertising about the speed of the broadband appears to vary widely across countries. Some carriers in countries such as Hong Kong,[30] Italy[31] and Poland,[32] advertise the theoretical

[29] *See, e.g.*, Aron, D. J. and D. E. Burnstein., "Broadband Adoption in the United States: An Empirical Analysis" March 2003, Mimeo; Gruber, H. and Koutroumpis, P., "Competition Enhancing Regulation and Diffusion of Innovation: The Case of Broadband Networks", Draft July 2011, electronic copy available at: http://ssrn.com/abstract=1898125.

[30] Hong Kong CSL. 1O1O 4G Ultimate Mobile Broadband Service Plan.

[31] Vodaphone Italia, Internet Speed (netbook) Plan (3G HSPA).

maximum available speeds, *i.e.* they report 100 Mbps for 4G and 42.2 Mbps for 3G HSPA+. In contrast, the highest speed advertised for a 4G plan in the United States is 5-12 Mbps and for a 3G plan it is 7.2 Mbps.[33]

Device discounts and phone plans that have to be purchased along with data plans vary widely by country as well. Phone plans associated with broadband also vary in terms of the number of minutes and text messages included in the plans. And because most broadband on smartphones is bought as a bundle with mobile voice, carriers may use the phone plans to cross-subsidize their data plans in some countries.

Given these issues, meaningful international comparisons of mobile pricing are extremely difficult. Below we compare mobile pricing focusing on just the broadband segment of mobile plans, and using the price per GB of data as the metric. These data should be taken with extreme caution, however. It is often impossible to value how much a GB of data is worth in a country when promotions are in terms of increasing usage limits. For example, in Australia, a smartphone plan by Vodafone has 0.5 GB usage limit, but infinite access to certain social networking sites, *e.g.* Facebook, while an Optus plan may have a 2 GB peak, 4 GB off-peak data limit, but unlimited access to certain unmetered sites, including Facebook and the carrier specific email account.[34] In these cases when we treat the usage limit as 0.5 GB for Vodafone or 3 GB for Optus, we may be inflating the price paid per GB of data. The same argument holds true for some plans in the United States such as T-Mobile's "Classic—Overage-Free Ultra" plan, where there is a usage limit of 10 GB, but instead of charging overage fees for exceeding the cap, T-Mobile reduces users' speeds. Additionally, usage patterns matter if we think about a volume-adjusted price, i.e. instead of diving the price by the usage limit, we divide price by the usage (or amount of data used). In that case, two countries may have very different GB limits but the same effective price (or volume-adjusted price) given different usage.

In addition, the comparisons below do not account for differences in speeds offered in different countries, nor were we able to account for device discounts. Given these and other limitations, the data should be treated with care. We nevertheless provide this detailed data on mobile broadband plans as an initial step for future analysis.

Commission's Web Harvest Data

For the first time, Commission staff has compiled a dataset of publicly available advertised pricing information for mobile broadband services in 38 countries (including the United States), most of which are members of the OECD. Staff collected this pricing information between October 2011 and February 2012.[35] The dataset includes information on advertised monthly recurring charges and

[32] Polkomtel, iPlus 20 GB w/out night/morning limit (4G Plan) Plan; PTK Centertel (Orange), Orange Free Z 19 Plan (3G HSPDA+).

[33] Verizon 4G Smartphone plan 8, AT&T LG Phoenix (3G)

[34] Vodafone Infinite 500M, Optus Data Cap 2

[35] We assembled the data by visiting the websites of broadband providers serving the countries and communities in our sample. In order to mitigate the effects of variations in a particular broadband provider's prices over time, we visited the websites of providers and downloaded the relevant information at one specific point in time. Thus, data was collected between October 2011 and February 2012. Our price data reflects only what a given provider was offering at the specific point in time we accessed its website. For some countries in the dataset, we were able to determine whether the offerings were on a national or community level. Many advertised offerings were national in scope, though some were listed for particular cities or on an "as available" basis. Because we obtained the information for the dataset at specific points in time, we were not able to determine which offers are regularly

nonrecurring charges such as connection fees for four types of device (smartphones, stick modems, tablets and netbooks), to allow for a more complete pricing analysis of each mobile broadband offering. We have fairly complete information on 1,765 mobile plans for the 38 countries, out of which 100 are United States plans. There are 857 smart phone plans, 531 stick modem plans, 289 tablet plans, and 88 netbook plans.

The dataset also includes promotional discounts and rebates such as those associated with online sign-up and longer service contracts, and the duration of those promotions. Additionally, information on device charges (such as the cost of a smart phone or modem) is also included. This allows for a more nuanced analysis of the price that a customer pays for a mobile broadband plan. The dataset includes upload and download speeds,[36] limitations on data usage, and information on the type of technology, *i.e.* whether it is 3G, 3.5G, GSM, 4G and so on.[37] Additionally, the usage limits on each plan and the consequences of reaching that usage limit are reported, such as the extra charge customers may incur, or whether they experience a slowdown of their speeds. The dataset also shows whether the broadband belongs to a bundle, i.e. includes mobile voice.

To compare prices across countries, we first construct an annual or monthly price that reflects all the rebates, charges and fees associated with each plan. To accomplish this, we calculate what the customer pays over the life of the contract, using the formula discussed earlier in the report for fixed broadband prices.[38] We do not include the device charges, or the monthly phone plan charges that accompany the data plan in the calculation. To the extent that the plan includes a subsidized device, such an approach will mean that the price for the broadband service will include sufficient margin to repay that subsidy – i.e., the price for bandwidth will appear more expensive. We then calculate the monthly net price by dividing it by the length of the contract. Next, we convert all prices to U.S. dollars based on both purchasing power parity (PPP) and current exchange rates. For reasons discussed earlier, we use the PPP conversions for the following analyses.

Comparing the Average Net Price of Monthly Plans

The price data for mobile broadband plans is complex and the data plans vary by the type of device. One important metric however, is the amount of data included in a plan. Therefore, for mobile broadband, we compare the net price per gigabyte of data, i.e. the price for total capacity (before hitting a penalty rather than a price per bit consumed) for four device types – smartphones, stick modems, tablets and netbooks. Plans that are advertised as unlimited data plans but that have customer speeds slowed down after a certain data limit is reached are classified as plans with usage limits. For example, the "Unlimited Mobiilinet M" plan by Tele 2 Estonia states that the particular plan is unlimited – however, there is a reasonable use policy in place and after reaching 30 GB, download speed is reduced to 200 Kbps and upload speed is reduced to 64 Kbps. The usage limit in this case would be 30 GB. Only those "unlimited" plans that have no overages or speed slowdowns are classified as truly unlimited. For unlimited plans we present the monthly average price and not the price per GB metric.

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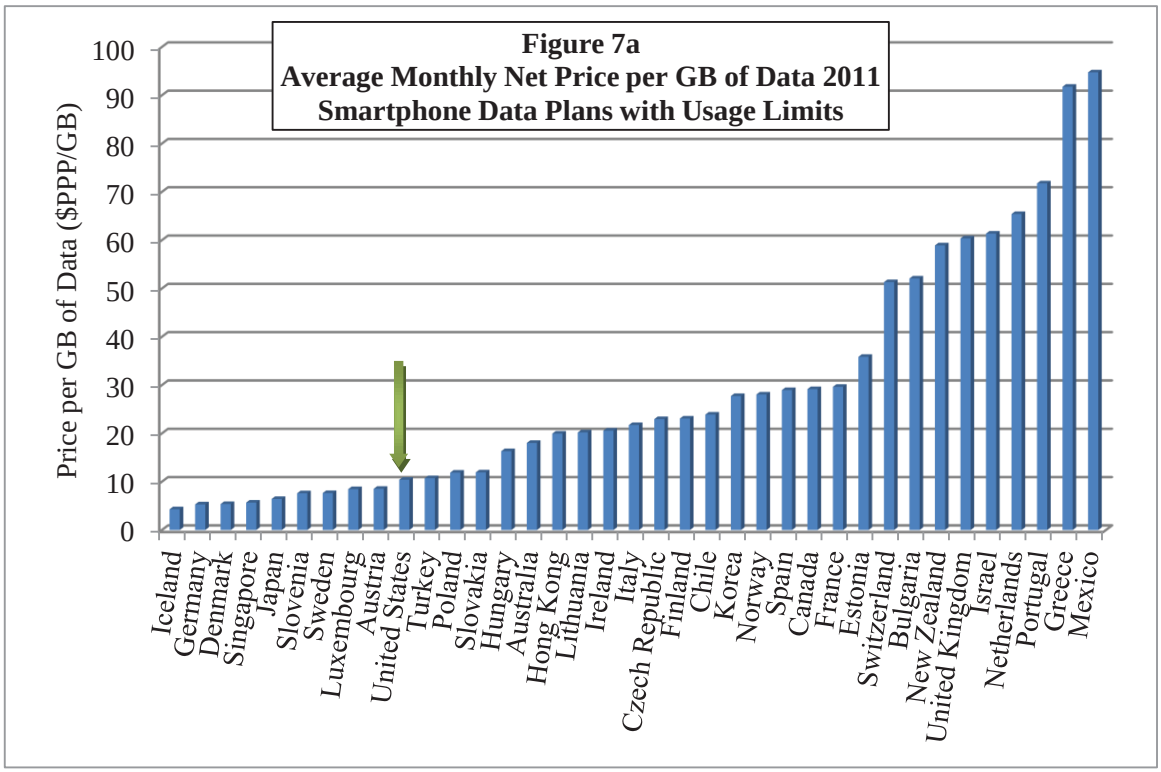
available and which are significant departures from regularly available offers. Therefore, while ideally we would include only widely and regularly available offerings, it is possible we captured information on some non-standard offers such as special, promotional, or other limited offers.

[36] In some cases, providers did not indicate upload speeds on their websites.

[37] We probably only collect "the best" advertised technology and that the technology actually in use by any customer at any time depends on a number of factors (e.g., location, spectrum band, network congestion) – so someone on a 4G plan could easily spend most of their time using the 3G network.

[38] Net price for the contract term = (promotional price * number of months promotion lasts) + (standard price * (contract term – number of months promotion lasts)) + installation fee + activation fee + modem rental charge + other fees (incl. line charges) – rebates.

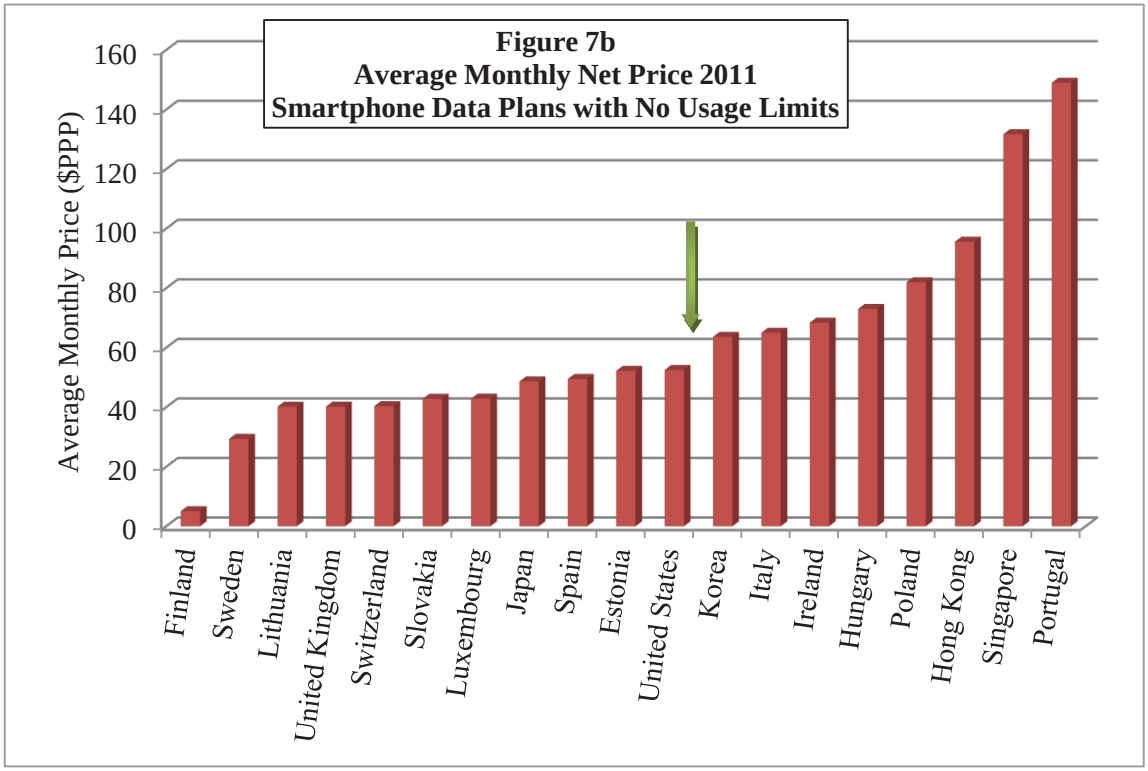
Figures 7a-10a shows the net price per gigabyte of data for plans with usage limits, and Figures 7b-10b reports the average monthly net price for unlimited data plans.



Note: Belgium does not have any limited data plans in the sample. Japan charges by the amount of packets sent, so we assumed 1 packet = 128 bytes according to the advertised plan. These prices are for the data plan only and do not include the price of the phone plan or device charge.

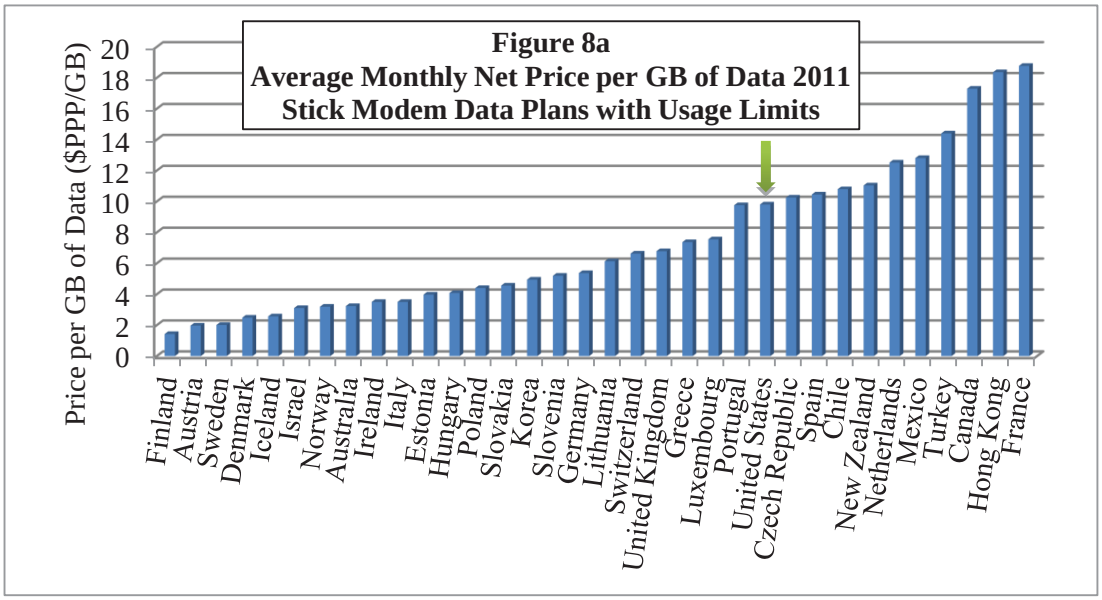
The net price per GB for an "average" smartphone plan with usage limits are presented in Figure and Appendix Table 7a.[39] We find that the United States is among the ten cheapest countries for smartphone data plans with usage limits, with an average price of $10/GB. Iceland, Finland and Germany are the three lowest price countries with an average price of $5/GB. Figure 7b and Appendix Table 7b show the net price for unlimited data plans, Finland is the cheapest country ($5.08) and Portugal is the most expensive ($148.99). The United States lies in the middle with $52.50.

[39] Most Japanese plans in the data set charge by the amounts of packets sent and not by gigabyte of data use. We use 1 packet = 128 bytes to convert the number of packets into gigabytes. The phone company website provides this information. See: http://www.au.kddi.com/english/packetwin/service/waribiki.html.

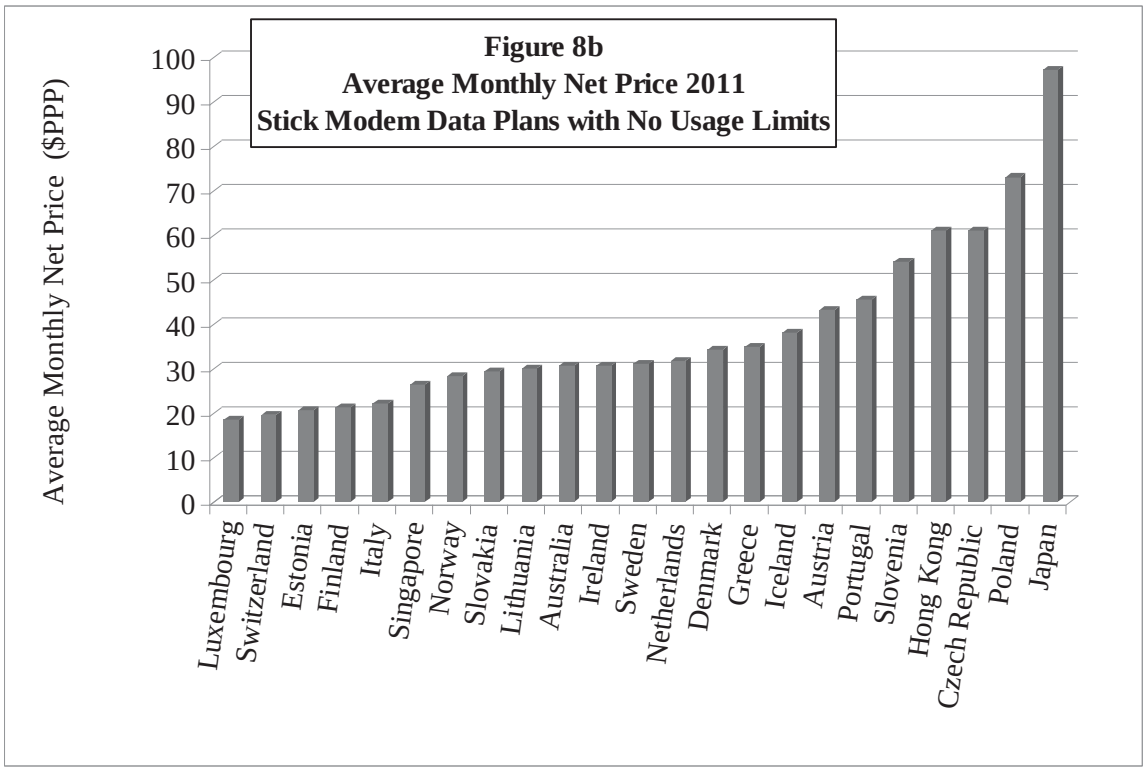


Note: Belgium does not have any unlimited data plans in the sample. The above net prices are for the data plan only and do not include the price of the phone plan or device charge. Countries not listed in Figure 7b do not have unlimited data plans in the sample.

Figure 8a and Appendix Table 8a shows that for stick modem data plans, Finland, Austria and Sweden have the lowest prices, with an average of $2/GB. Excluding Japan, the three most expensive countries are Canada, France and Hong Kong, with an average price of over $17/GB. Japan is the most expensive country in our sample with an average price of $62.38/GB for modem plans. The United States is 24th out of 34 countries, with an average price of $9.80/GB. Figure 8b and Appendix Table 8b show that for plans with no usage limits, Luxembourg is the cheapest country ($18.53) and Japan is the most expensive ($97.31). The United States does not have any unlimited data plans for stick modems in the sample.

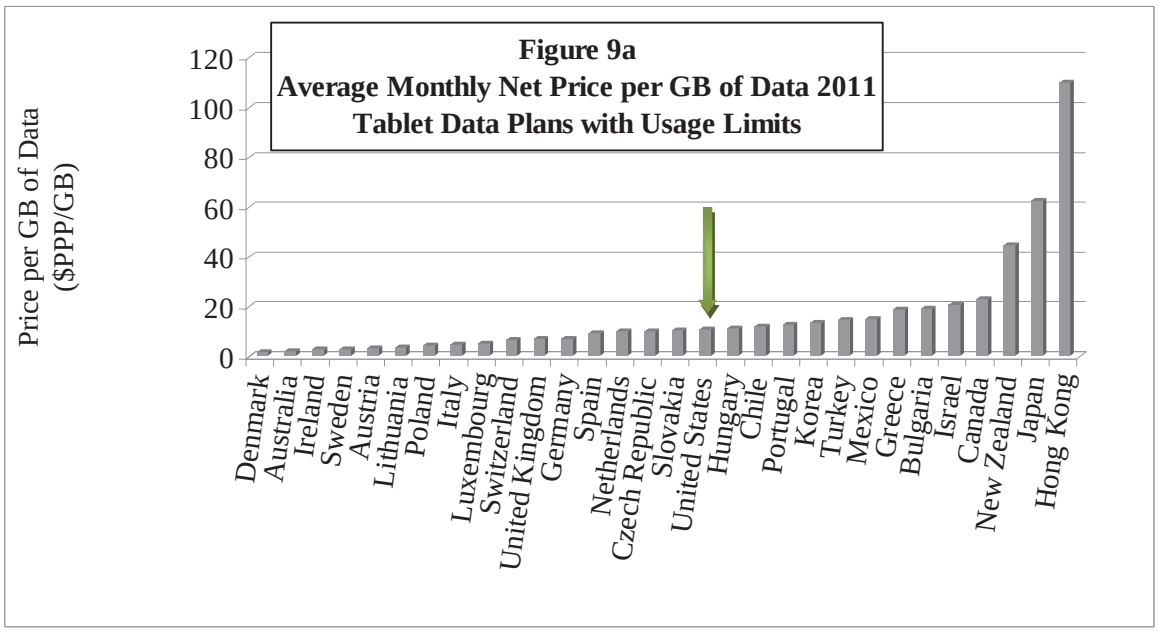


Note: Japan charges by the amount of packets sent, so we assumed 1 packet = 128 bytes as mentioned in their plan and it is the most expensive. We exclude Japan from the graph due to this extreme value. These prices are for the data plan only and do not include the price of the stick modem or other rental charges. Countries not listed in Figure 8a do not have stick modem plans with usage limits in our sample.

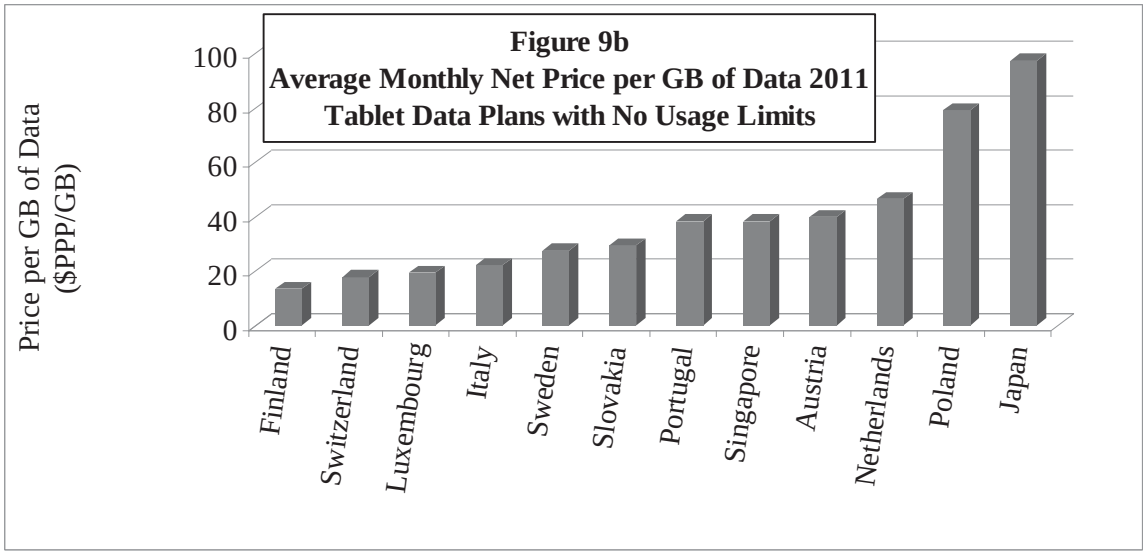


Note: The prices above are for the data plan only, and do not include the price of the stick modem or other rental charges. Countries not listed in Figure 8b do not have unlimited stick modem plans in our sample.

Figures 9a-9b and Appendix Tables 9a-9b present the results for tablet data plans. Denmark and Australia are the cheapest countries with a price of $2/GB for plans with usage limits and Hong Kong and Japan are the most expensive. The United States is in the middle with a price of $10.90/GB. For unlimited data plans, Figure 9b and Appendix Table 9b, show Finland being the least expensive countries ($13.37), with Poland and Japan as the most expensive at $79.12 and $97.31 respectively. The United States does not have any unlimited data plans for tablets.

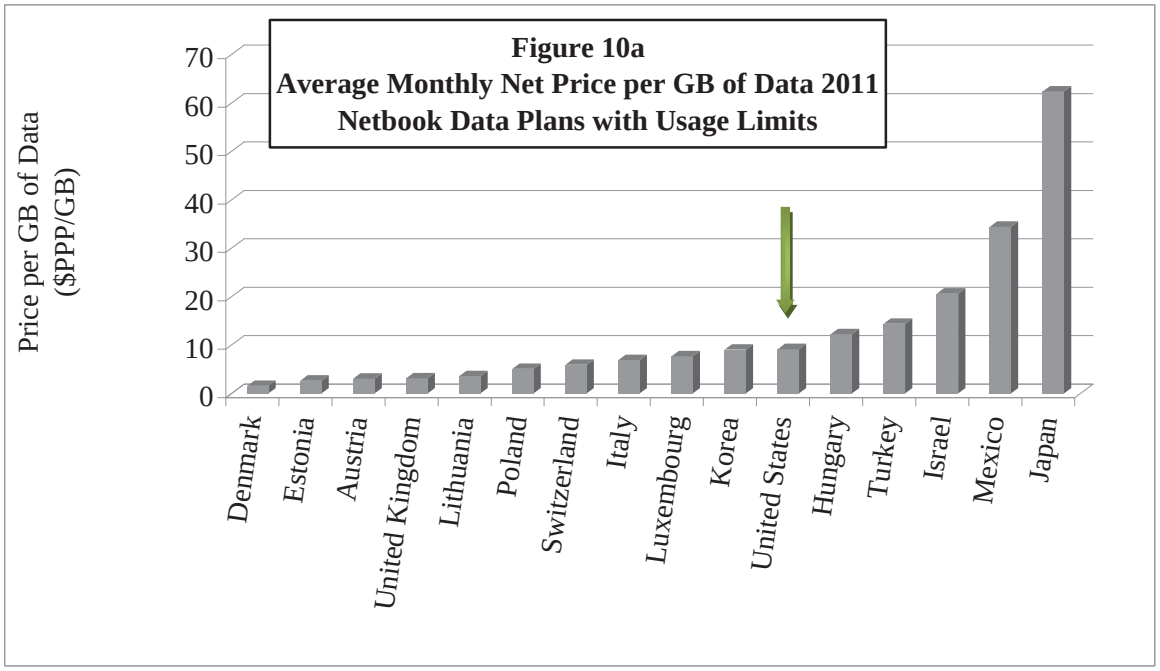


Note: Japan charges by the amount of packets sent, so we assumed 1 packet = 128 bytes as mentioned in their plan and it is the most expensive. The prices noted are for the data plan only and do not include the device charge. Countries not listed in Figure 9a do not have tablet plans with usage limits in our sample.

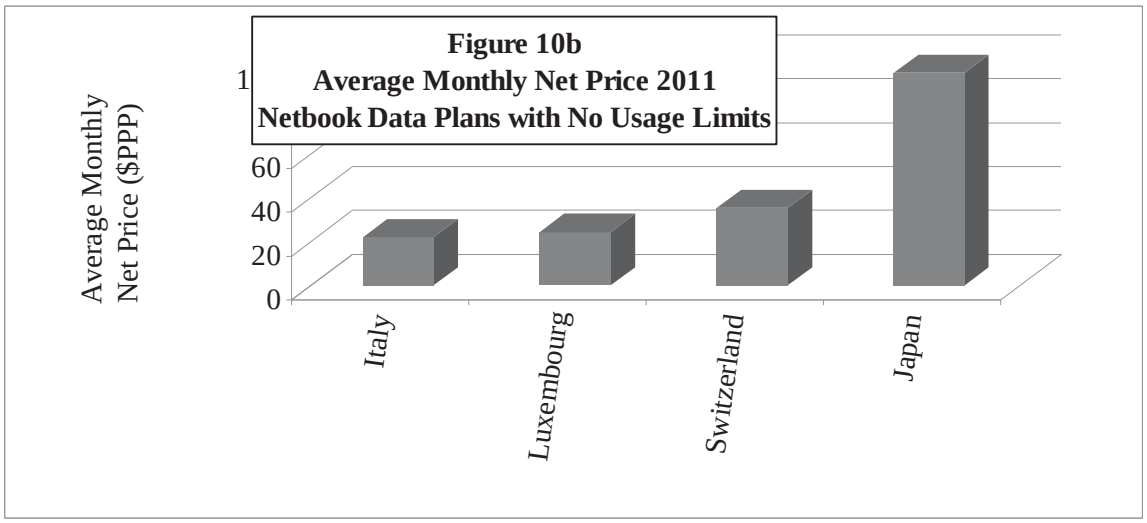


Note: The prices noted are for the data plan only, and do not include the device charge. For unlimited plans, we assume the usage limit to be 30 GB when calculating the per GB price. The download speed numbers are for the highest possible advertised speeds listed on the plan Countries not listed in Figure 9b do not have tablet plans with unlimited data in our sample.

There are some netbook plans for some countries, although the data is sparse. Figures 10a-10b and Appendix Tables 10a-10b present this data. We find that Denmark is the least expensive country for plans with usage limits, while Italy is the least expensive for unlimited data plans. The U.S. price is consistent with earlier findings and is around $10/GB.



Note: Japan charges by the amount of packets sent, so we assumed 1 packet = 128 bytes according to the advertised plan, and it is the most expensive. These prices are for the data plan only and do not include the device charge. Countries not listed in Figure 10a do not have netbook plans with usage limits in our sample.



Note: The prices noted are for the data plan only, and do not include the device charge. Countries not listed in Figure 8b do not have netbook plans with no usage limits in our sample.

Conclusion

This pricing section presents data from an unprecedented sample of fixed and mobile price offers from 38 countries. From the analysis of the data, we have concluded that the United States is in the mid-price range of countries, whether we compare by speed tier or price per gigabyte of data, for fixed residential broadband. For mobile broadband, particularly for smartphone plans, the United States is one of the ten least expensive countries in terms of price per gigabyte of data. In future work, with more granular data, a more systematic quality adjusted price index could be developed, allowing for better international comparison.

Appendix Table 1a
Number of Total, Unbundled and Bundled Broadband Plans 2011

Country	Total Number of Plans in the Sample	Number of Naked Broadband Plans	Number of Double Play Plans	Number of Triple Play Plans	Number of Quad Play Plans
Australia	90	48	32	10	
Austria	27	11	13	3	
Belgium	16	12	4		
Bulgaria	24	13	5	6	
Canada	31	27	2	2	
Chile	37	16	11	10	
Czech Republic	40	31	7	2	
Denmark	38	9	27	2	
Estonia	27	13	5	9	
Finland	24	23	1		
France	15	3		12	
Germany	26	7	18	1	
Greece	15	5	6	4	
Hong Kong	28	28			
Hungary	16	9		7	
Iceland	14	14			
Ireland	43	21	22		
Israel	30	26		1	3
Italy	30	2	22	6	
Japan	52	47	5		
Korea	130	56	45	29	
Lithuania	67	67			
Luxembourg	64	24	9	31	
Mexico	27	5	15	7	
New Zealand	37	5	31	1	
Norway	42	34	6	2	
Poland	89	40	11	25	13
Portugal	31	8	5	15	3
Singapore	105	5	50	50	
Slovakia	42	12	14	16	
Slovenia	75	43	1	31	
Spain	22		10	12	
Sweden	40	12	21	4	3
Switzerland	51	25	7	10	9
The Netherlands	38	11	3	24	
Turkey	41	28	9	4	
United Kingdom	34	1	12	15	6
United States	113	58	33	22	
Total	1,671	799	462	373	37

Appendix Table 1b
Average Monthly Net Price of a Broadband Package in US Dollars
(PPP and Exchange Rate Conversion)

Country	Price $ (PPP)	Price $ (Ex. Rate)	Rank (PPP)	Rank (Ex. Rate)
Germany	32.63	35.91	1	8
Korea	32.96	23.08	2	1
Estonia	33.25	26.07	3	2
Sweden	34.92	45.38	4	14
France	35.78	42.51	5	13
Italy	36.09	41.54	6	11
Finland	38.07	48.66	7	18
Iceland	39.12	42.00	8	12
Japan	41.85	50.93	9	19
Denmark	43.09	67.43	10	30
Czech Republic	43.62	31.70	11	3
Israel	44.31	45.45	12	15
Austria	45.07	51.04	13	20
United Kingdom	45.98	48.31	14	17
Slovakia	46.68	33.45	15	5
The Netherlands	46.93	53.46	16	23
Turkey	47.05	37.25	17	10
Hong Kong	47.11	32.92	18	4
Belgium	48.24	57.76	19	24
Greece	49.83	47.12	20	16
Hungary	50.06	34.74	21	6
Poland	54.16	35.06	22	7
Luxembourg	54.73	73.94	23	35
Norway	55.19	91.38	24	37
Portugal	56.68	51.95	25	21
Ireland	57.34	66.00	26	29
Canada	59.36	70.75	27	34
Spain	59.41	60.59	28	26
Australia	60.85	70.07	29	33
New Zealand	61.04	69.42	30	31
United States	69.75	69.75	31	32
Lithuania	71.47	77.50	32	36
Slovenia	71.80	59.82	33	25
Bulgaria	72.08	36.07	34	9
Chile	78.83	63.06	35	27
Mexico	78.93	52.98	36	22
Singapore	89.48	64.41	37	28
Switzerland	119.38	190.48	38	38

Note: The monthly cost reflects the price per month, rebates, installation charges, equipment charges such as modem rentals and other fees. So this is different from the simple monthly advertised price.

Appendix Table 2a
Average Monthly Net Price of a Standalone Broadband Plan ($ PPP) by Technology 2011
Advertised Download Speed between 1 – 5 Mbps

Country	All *	DSL	Cable	Fiber	Hybrid	Satellite	Average Download Speed
Hong Kong	21.50			21.50			1.50
Poland	22.51	28.22	16.79				1.75
The Netherlands	23.20		23.20				5.00
Israel	24.09	20.63	26.00	25.64			3.33
Slovakia	24.21			24.21			2.00
Greece	26.41	26.41					2.00
Canada	26.86		26.86				1.50
Estonia	27.03	27.03		27.03			5.00
Czech Republic	27.81	34.81	19.81	28.82			1.33
Hungary	28.18	28.18					2.95
Finland	29.19	30.78	27.59				2.17
Ireland	29.64	27.64		31.64			2.17
Japan	32.92	37.95			27.90		1.13
United States	34.93	34.12	42.30		29.99	84.32	2.78
Turkey	35.78	35.78					2.67
Luxembourg	36.32	36.32					5.00
Mexico	37.76		37.76				3.00
Belgium	38.21	38.21					2.50
Slovenia	42.66	43.72	33.39	50.87			2.94
Australia	45.67	45.67					3.25
Norway	49.02	56.04		34.98			2.15
Chile	49.18	49.18					2.17
Lithuania	81.90	81.90					3.82
Switzerland	119.33	167.24		23.49			4.00
Portugal						26.13	
Germany						58.10	

Note: The monthly cost reflects the price per month, rebates, installation charges, equipment charges such as modem rentals and other fees. So this is different from the simple monthly advertised price. Spain did not have any naked broadband plans in the sample. '*' The simple average is calculated by excluding satellite

Appendix Table 2b
Average Monthly Net Price of a Standalone Broadband Plan ($ PPP) by Technology 2011
Advertised Download Speed between 5 – 15 Mbps

Country	All *	DSL	Cable	Fiber	Hybrid	Satellite	Average Down Speed
Slovakia	20.56			20.56			10.00
Italy	21.86			21.86			10.00
Bulgaria	23.05	27.06	19.03			246.62	15.00
Sweden	25.74	25.34	26.13				7.75
The Netherlands	27.13	27.13					8.00
Austria	27.76	21.06	34.46				9.03
Korea	30.62				30.62		10.00
Israel	31.83	30.74	29.91	34.85			11.83
Poland	31.91	36.71	29.46	29.56			9.38
Finland	32.46	35.76	34.79	26.84			9.67
Denmark	32.84		42.04	23.63			12.50
Hungary	34.40	51.46		17.33			11.25
Luxembourg	37.31	41.26		29.41			11.67
Iceland	38.00	38.00					11.40
Canada	38.30		44.48	32.13			8.00
Ireland	38.58	40.46		36.70		95.49	8.03
Czech Republic	40.69	64.37	33.76	23.95			10.00
Turkey	42.52	48.07		36.97			8.86
Japan	42.76	48.26			37.26		11.00
Singapore	43.04		43.04				10.00
United States	43.71	40.84	44.75	54.99	39.99		10.52
Slovenia	45.53	59.22	42.39	34.98			9.81
Norway	46.02	41.31		50.73			9.29
Belgium	49.10	50.89	45.54				12.00
Australia	50.35	59.59	47.56	43.90			9.33
Hong Kong	52.25	79.91	47.06	29.79			9.33
Chile	52.30	52.30					10.25
Lithuania	52.97	98.35		7.60			8.37
New Zealand	53.65		53.65				15.00
Mexico	95.59		95.59				7.00
Switzerland	185.10	185.10					9.25
Portugal						52.67	

Note: The monthly cost reflects the price per month, rebates, installation charges, equipment charges such as modem rentals and other fees. So this is different from the simple monthly advertised price. Spain did not have any naked broadband plans in the sample. '*' The simple average is calculated by excluding satellite

Appendix Table 2c
Average Monthly Net Price of a Standalone Broadband Plan ($ PPP) by Technology 2011
Advertised Download Speed between 15 – 25 Mbps

Country	All *	DSL	Cable	Fiber	Hybrid	Satellite	Average Down Speed
Slovakia	17.91			17.91			25.00
Korea	19.25				19.25		20.00
Italy	21.86	21.86					20.00
Hungary	22.18			22.18			25.00
France	23.41	23.41					20.00
United Kingdom	28.68	28.68					20.00
The Netherlands	30.68	38.76	31.49	21.80			21.67
Turkey	30.85	39.68		22.02			18.50
Bulgaria	31.46	33.83		29.09			20.00
Sweden	32.76	32.98	32.53				19.25
Estonia	33.78	33.78					20.00
Poland	34.68	36.88	32.46	34.69			21.67
Greece	35.08	35.08					24.00
Germany	35.28	35.28					16.00
Austria	39.86	26.49	53.24				19.44
Denmark	41.06	33.95	48.17				20.00
Canada	41.91		37.44	46.38			22.75
Norway	42.80	35.73		56.96			20.39
Belgium	43.32		43.32				22.50
Israel	44.29	61.25	35.12	36.51			20.00
Czech Republic	46.32	54.53		29.89			21.63
Hong Kong	49.06			49.06			18.00
Australia	50.51	55.54		45.48			23.23
Finland	50.89	50.89					22.00
Ireland	52.12	54.16		50.08			24.17
United States	56.50	49.12	59.27	74.99	49.99		21.45
Iceland	58.62	58.62					16.00
Slovenia	59.53	70.48	63.59	44.52			20.00
Chile	61.24	61.24					20.00
Luxembourg	71.48	71.48					21.33
New Zealand	124.53		124.53				25.00
Switzerland	179.61	242.89		116.34			20.83

Note: The monthly cost reflects the price per month, rebates, installation charges, equipment charges such as modem rentals and other fees. So this is different from the simple monthly advertised price. Spain did not have any naked broadband plans in the sample. '*" – The simple average is calculated by excluding satellite

Appendix Table 3a
Average Monthly Net Price of a Double Phone DSL Broadband Plan ($ PPP) with Unlimited Local and National Calling (Broadband Download Speed 1 – 25 Mbps) 2011

Country	Monthly Net Price ($PPP)
Sweden	18.40
Germany	36.02
Italy	37.82
Denmark	42.09
Austria	42.28
Belgium	44.25
United Kingdom	47.98
New Zealand	55.45
Spain	59.75
United States	61.82
Australia	62.55
Greece	65.28
Ireland	67.88
Luxembourg	72.19
Chile	81.52
Mexico	94.21
Singapore	139.00

Appendix Table 3b
Average Monthly Net Price of a Double Phone Broadband Plan ($ PPP) by Speed Tier 2011

	1-5 Mbps	5-15 Mbps	15-25 Mbps
Country	**$PPP**	**$PPP**	**$PPP**
Australia	57.24	66.45	62.55
Austria		35.95	53.28
Belgium	42.97	53.47	
Bulgaria		40.51	
Chile	83.27	75.92	
Czech Republic			32.06
Denmark	26.59	31.63	42.2
Estonia	23.63	37.15	
Germany	33.02	26.17	23.32
Greece			51.91
Ireland	57.98	55.27	71.9
Italy	25.45	36.2	38.85
Japan		20.04	
Korea		26.56	
Luxembourg	25.49	44.12	70.67
Mexico	69.21	101.28	138.42
New Zealand		45.01	
Norway	13.31		7.89
Poland	45.6	49.44	43.87
Portugal		21.66	28.89
Singapore	32.92	41.86	59.22
Slovakia	22.08	41.03	44.94
Spain		41.75	39.55
Sweden	25.05	24.33	18.4
Switzerland	24.99		43.18
The Netherlands			26.16
Turkey	32.77		44.57
United Kingdom			42.06
United States	51.56	63.08	73.52

Appendix Table 3c
Average Monthly Net Price of a Double Video Broadband Plan ($ PPP) by Speed Tier 2011

	1-5 Mbps	5-15 Mbps	15-25 Mbps
Country	**$PPP**	**$PPP**	**$PPP**
Austria		25.73	
Bulgaria		29.5	29.5
Chile	68.54		
Czech Republic	28.68		52.83
Denmark		22.61	28.29
Germany			44.26
Italy			26.47
Luxembourg			
Mexico	56.59	93.41	131.54
The Netherlands			42.64
New Zealand		41.49	
Poland	60.92	64.76	52.03
Slovakia			
United States	54.91	87.93	105.99

Appendix Table 3d
Average Monthly Net Price of a Triple Play Broadband Plan ($ PPP) by Speed Tier 2011

	1-5 Mbps	5-15 Mbps	15-25 Mbps
Country	**$PPP**	**$PPP**	**$PPP**
Australia			77.28
Austria		48.13	55.31
Bulgaria		34.3	34.91
Canada			
Chile	96.34	110.21	
Czech Republic			53.67
Denmark			52.91
Estonia	25.32	38.83	
France			37.24
Germany			38.29
Greece	63.49		75.46
Hungary		66.71	64.71
Israel	76.92		
Italy		46.12	44.88
Korea		34.32	
Luxembourg	35.64	45.98	54.8
Mexico	73.05	124.66	173.99
New Zealand		56.87	
Norway			12.89
Poland	37.51	72	62.35
Portugal		51.42	21.67
Singapore		42.96	60.16
Slovakia	57.24		48.83
Slovenia	63.26	73.13	79.49
Spain		57.09	66.17
Sweden		34.92	
Switzerland	41.47	58.06	55.07
The Netherlands		45.47	53.03
Turkey	62.19		
United Kingdom			45.07
United States	86.87	118.2	95.97

Appendix Table 4a
Average Monthly Net Price per GB of Data ($ PPP/GB) 2011
Plans with Hard Data Caps

Country	Monthly Net Price per GB ($PPP/GB)	Country	Monthly Net Price per GB ($PPP/GB)
Denmark	0.2	Slovakia	7.96
Estonia	0.68	Portugal	9.35
United States	0.76	Austria	11.41
Canada	1.67	Turkey	12.40
United Kingdom	3.25	Belgium	12.86
Australia	3.29	New Zealand	19.31
Iceland	3.91	Sweden	24.06
Luxembourg	4.49	Bulgaria	25.77

Appendix Table 4b
Average Monthly Net Price ($ PPP) 2011
Plans with No Usage Limits

Country	Monthly Net Price ($PPP)	Country	Monthly Net Price ($PPP)
Sweden	31.68	United Kingdom	53.70
Estonia	32.43	Poland	54.16
Germany	32.63	Luxembourg	54.89
Korea	32.96	Norway	55.19
France	35.78	Ireland	57.34
Italy	36.09	Spain	59.41
Bulgaria	37.18	Portugal	60.09
Finland	38.07	Czech Republic	61.05
Japan	41.85	Lithuania	71.47
Denmark	43.38	United States	73.06
Israel	44.31	Australia	76.52
The Netherlands	46.93	Chile	78.83
Hong Kong	47.11	Mexico	78.93
Slovakia	49.04	Singapore	89.48
Greece	49.83	Turkey	93.00
Hungary	50.06	Slovenia	101.68
Belgium	50.14	Canada	102.38
Austria	52.52	Switzerland	151.31

Appendix Table 5
Average Price (US$) per Mbps of Download Speed by Country

Country	$/Mbps 2010	$/Mbps 2011
Bulgaria	0.67	0.69
Lithuania	1.74	1.33
Slovakia	3.32	2.03
Hungary	2.51	2.16
Hong Kong		2.31
Czech Republic	2.85	2.96
Poland		3.15
Iceland		3.30
Netherlands	3.41	3.41
Israel		3.51
Germany	2.67	3.54
United Kingdom	3.60	3.54
Denmark	3.45	3.59
Switzerland	3.54	3.91
Sweden	5.29	4.48
Finland	3.99	4.49
Austria	4.75	4.55
Singapore		5.01
Estonia		5.02
Slovenia		5.36
France		5.40
Belgium	6.46	5.61
Turkey		5.77
Greece		5.87
United States	6.75	6.14
Norway	6.44	6.21
Canada	6.43	6.22
Portugal	6.78	6.43
Ireland		7.02
Italy		7.06
Spain		8.13
New Zealand		9.30
Chile		11.25
Australia	11.84	11.60
Mexico		12.80

Source: Value Index from the Net Index database provided by Ookla. Japan and South Korea are not in this dataset.

Appendix Table 6
Average Weighted Price (US$) per Mbps of Download Speed 2011 By U.S. States and International Countries

Lowest 25th Price Percentile		Middle 50 Percent				Highest 25th Price Percentile	
Country	**Price (US$)/ Mbps**	**Country**	**Price (US$)/ Mbps**	**Country**	**Price (US$)/ Mbps**	**Country**	**Price (US$)/ Mbps**
Bulgaria	0.69	Kentucky	4.62	Nebraska	5.78	Idaho	7.83
Lithuania	1.33	New York	4.80	Kansas	5.80	Maryland	8.06
Slovakia	2.03	Minnesota	4.87	Texas	5.85	Illinois	8.06
Hungary	2.16	Oregon	4.91	Greece	5.87	North Dakota	8.13
Hong Kong	2.31	Arizona	4.92	Utah	5.93	Michigan	8.13
South Dakota	2.36	Singapore	5.01	Oklahoma	6.05	Spain	8.13
Delaware	2.91	Estonia	5.02	Norway	6.21	New Mexico	8.37
Czech Republic	2.96	Washington	5.02	Canada	6.22	Iowa	8.40
Poland	3.15	Florida	5.15	New Jersey	6.25	Montana	8.74
Iceland	3.30	South Carolina	5.17	California	6.32	Massachusetts	9.10
Netherlands	3.41	Colorado	5.20	Nevada	6.34	Pennsylvania	9.27
Israel	3.51	Wyoming	5.24	Portugal	6.43	New Zealand	9.30
Germany	3.54	Wisconsin	5.28	Louisiana	6.44	West Virginia	9.36
United Kingdom	3.54	Slovenia	5.36	Alabama	6.44	New Hampshire	10.78
Denmark	3.59	Connecticut	5.39	Hawaii	6.48	Chile	11.25
Rhode Island	3.66	France	5.40	Indiana	6.99	Mississippi	11.51
Switzerland	3.91	Georgia	5.47	Ireland	7.02	Australia	11.60
Sweden	4.48	Tennessee	5.48	Italy	7.06	Alaska	11.71
Finland	4.49	Belgium	5.61	Ohio	7.19	District of Columbia	11.75
Virginia	4.51	North Carolina	5.62	Arkansas	7.21	Maine	12.03
Austria	4.55	Turkey	5.77	Missouri	7.50	Mexico	12.80

Note: The table is based on the Ookla Value Index data. We create a weighted average price by using the number of tests/surveys as the weights for each median price reported by Ookla, and then taking the average over all cities and dates to create an annual average weighted price.

Appendix Table 7a
Smartphone Data Plans with Usage Limits 2011

Country	Price per GB of Data ($PPP/GB)	Average Price per Month ($PPP)	Average Data Cap (GB)	Download Speed (Mbps)
Iceland	4.29	11.86	2.77	7.20
Germany	5.29	43.03	8.13	17.73
Denmark	5.37	28.17	5.25	15.00
Singapore	5.67	35.44	6.25	7.20
Slovenia	7.60	17.81	2.34	21.37
Sweden	7.64	37.72	4.94	9.19
Luxembourg	8.45	20.59	2.44	7.20
Austria	8.52	30.40	3.57	17.83
United States	10.40	54.82	5.27	6.41
Turkey	10.72	20.86	1.95	11.12
Poland	11.87	35.79	3.01	46.44
Slovakia	11.92	15.49	1.30	17.31
Hungary	16.31	52.44	3.22	8.87
Australia	18.02	34.32	1.90	7.23
Hong Kong	19.95	44.70	2.24	60.36
Lithuania	20.19	22.56	1.12	7.35
Ireland	20.56	56.76	2.76	10.74
Italy	21.72	49.54	2.28	17.28
Czech Republic	22.96	18.65	0.81	11.90
Finland	23.07	25.03	1.09	16.00
Chile	23.89	101.52	4.25	
Korea	27.72	51.30	1.85	
Norway	28.05	32.33	1.15	36.67
Spain	28.96	46.24	1.60	5.30
Canada	29.16	56.49	1.94	66.75
France	29.64	32.01	1.08	14.40
Estonia	35.84	23.75	0.66	21.60
Switzerland	51.31	29.32	0.57	
Bulgaria	52.06	42.12	0.81	24.32
New Zealand	58.91	50.08	0.85	7.30
United Kingdom	60.36	39.15	0.65	5.54
Israel	61.35	66.47	1.08	7.20
Netherlands	65.41	73.04	1.12	9.26
Portugal	71.74	52.61	0.73	59.93
Greece	91.76	93.14	1.02	28.20
Mexico	94.73	76.67	0.81	4.53
Japan	606.92	10.02	0.02	7.20

Note: Belgium does not have any limited data plans in the sample. Japan charges by the amount of packets sent, so we assumed 1 packet=128 bytes. These prices are for the data plan only and do not include the price of the phone plan or device charge. The download speed numbers are for the highest possible advertised speeds listed on the plan.

Appendix Table 7b
Smartphone Data Plans Without Usage Limits 2011

Country	Average Price per Month ($PPP)	Download Speed (Mbps)
Finland	5.08	0.50
Sweden	29.38	16.00
Lithuania	40.19	21.60
United Kingdom	40.20	3.90
Switzerland	40.36	
Slovakia	42.83	14.16
Luxembourg	42.89	
Japan	48.66	7.20
Spain	49.50	15.90
Estonia	52.22	5.60
United States	52.50	6.70
Korea	63.63	
Italy	65.02	14.40
Ireland	68.41	7.20
Hungary	73.02	60.00
Poland	81.97	100.00
Hong Kong	95.60	100.00
Singapore	131.71	14.10
Portugal	148.99	7.20

Note: Belgium does not have any unlimited data plans in the sample. These prices are for the data plan only and do not include the price of the phone plan or device charge. For unlimited plans, we assume the data cap to be 30GB when calculating the per GB price. The download speed numbers are for the highest possible advertised speeds listed on the plan.

Appendix Table 8a
Stick Modem Data Plans With Usage Limits 2011

Country	Price per GB of Data ($PPP/GB)	Average Price per Month ($PPP)	Average Data Cap (GB)	Download Speed (Mbps)
Finland	1.42	10.32	7.25	8.38
Austria	1.97	16.51	8.39	13.80
Sweden	2.01	19.59	9.75	16.66
Denmark	2.48	44.74	18.01	48.27
Iceland	2.57	17.96	7.00	7.20
Israel	3.10	31.03	10.00	7.20
Norway	3.19	19.43	6.09	13.21
Australia	3.23	30.26	9.36	22.67
Ireland	3.50	28.18	8.05	12.08
Italy	3.50	22.95	6.56	16.09
Estonia	3.97	59.62	15.00	38.85
Hungary	4.08	30.77	7.55	13.93
Poland	4.40	31.03	7.06	61.54
Slovakia	4.56	26.37	5.79	28.43
Korea	4.94	51.89	10.50	
Slovenia	5.19	25.97	5.00	31.80
Germany	5.36	36.76	6.85	13.28
Lithuania	6.13	18.38	3.00	21.60
Switzerland	6.63	27.34	4.13	18.80
United Kingdom	6.78	21.96	3.24	9.37
Greece	7.37	31.14	4.23	29.47
Luxembourg	7.55	21.89	2.90	7.20
Portugal	9.75	27.23	2.79	2.62
United States	9.80	58.83	6.00	6.04
Czech Republic	10.25	32.63	3.18	6.50
Spain	10.45	32.22	3.08	8.17
Chile	10.79	62.21	5.77	8.95
New Zealand	11.03	34.84	3.16	7.40
Netherlands	12.52	24.40	1.95	7.76
Mexico	12.81	42.72	3.34	14.40
Turkey	14.40	43.88	3.05	13.13
Canada	17.29	38.19	2.21	64.00
Hong Kong	18.36	55.07	3.00	100.00
France	18.76	37.90	2.02	
Japan	5466.01	97.31	0.02	7.20

Note: Belgium, Bulgaria and Singapore did not have any limited data plans in the sample. Japan charges by the amount of packets sent, so we assumed 1 packet=1000 bytes. These prices are for the data plan only and do not include the price of the phone plan or device charge. The download speed numbers are for the highest possible advertised speeds listed on the plan.

Appendix Table 8b
Stick Modem Data Plans Without Usage Limits 2011

Country	Average Price per Month ($PPP)	Download Speed (Mbps)
Luxembourg	18.53	7.20
Switzerland	19.63	
Estonia	20.60	3.67
Finland	21.25	35.38
Italy	22.05	21.60
Singapore	26.45	3.47
Norway	28.38	100.00
Slovakia	29.39	42.00
Lithuania	30.03	21.60
Australia	30.61	7.20
Ireland	30.68	14.23
Sweden	31.12	42.68
Netherlands	31.73	8.40
Denmark	34.16	80.00
Greece	34.87	7.20
Iceland	38.03	7.20
Austria	43.27	60.00
Portugal	45.51	20.36
Slovenia	54.05	21.60
Hong Kong	61.06	53.60
Czech Republic	61.16	21.60
Poland	73.09	55.33
Japan	97.31	7.20

Note: Belgium, Bulgaria, Canada, Chile, France, Germany, Greece, Hungary, Israel, Korea, Mexico, New Zealand, Spain, Turkey, UK and the US did not have any unlimited data plans in the sample. Japan charges by the amount of packets sent, so we assumed 1 packet=1000 bytes. These prices are for the data plan only and do not include the price of the phone plan or device charge. For unlimited plans, we assume the data cap to be 30GB when calculating the per GB price. The download speed numbers are for the highest possible advertised speeds listed on the plan.

Appendix Table 9a
Tablet Data Plans With Usage Limits 2011

Country	Price per GB of Data ($PPP/GB)	Average Price per Month ($PPP)	Average Data Cap (GB)	Download Speed (Mbps)
Denmark	1.73	17.74	10.28	6.80
Australia	2.10	21.34	10.14	7.62
Ireland	2.74	19.17	7.00	16.47
Sweden	2.74	13.45	4.90	10.15
Austria	3.02	34.76	11.50	8.60
Lithuania	3.57	14.29	4.00	7.20
Poland	4.12	53.51	13.00	22.50
Italy	4.62	24.37	5.27	15.13
Luxembourg	5.21	20.31	3.90	
Switzerland	6.63	27.34	4.13	18.80
United Kingdom	7.06	26.48	3.75	4.65
Germany	7.09	48.58	6.85	13.28
Spain	9.10	36.20	3.98	15.15
Netherlands	9.93	17.68	1.78	9.84
Czech Republic	10.02	32.27	3.22	5.64
Slovakia	10.41	15.62	1.50	42.00
United States	10.91	48.04	4.40	5.81
Hungary	10.94	33.52	3.06	11.24
Chile	11.83	41.40	3.50	4.00
Portugal	12.47	20.78	1.67	11.90
Korea	13.54	39.72	2.93	
Turkey	14.48	43.52	3.01	12.00
Mexico	14.93	38.40	2.57	7.20
Greece	18.67	18.67	1.00	42.20
Bulgaria	18.99	30.85	1.63	42.00
Israel	20.60	20.60	1.00	7.20
Canada	22.95	40.48	1.76	58.50
New Zealand	44.63	29.65	0.66	7.52
Hong Kong	109.97	54.98	0.50	
Japan	5466.01	97.31	0.02	7.20

Note: Belgium, Estonia, Finland, France, Iceland, Norway, Singapore and Slovenia did not have any limited data plans in the sample. Japan charges by the amount of packets sent, so we assumed 1 packet=1000 bytes. These prices are for the data plan only and do not include the price of the phone plan or device charge. The download speed numbers are for the highest possible advertised speeds listed on the plan.

Appendix Table 9b
Tablet Data Plans Without Usage Limits 2011

Country	Average Price per Month ($PPP)	Download Speed (Mbps)
Finland	13.37	15.00
Switzerland	17.73	
Luxembourg	19.25	
Italy	22.05	21.60
Sweden	27.38	34.25
Slovakia	29.39	42.00
Portugal	38.14	14.10
Singapore	38.22	7.20
Austria	39.85	10.00
Netherlands	46.27	8.40
Poland	79.12	24.00
Japan	97.31	7.20

Note: Australia, Belgium, Bulgaria, Canada, Chile, Czech Republic, Denmark, Estonia, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Korea, Lithuania, Mexico, New Zealand, Norway, Slovenia, Spain, Turkey, UK and the US did not have any unlimited data plans in the sample. These prices are for the data plan only and do not include the price of the phone plan or device charge. For unlimited plans, we assume the data cap to be 30GB when calculating the per GB price. The download speed numbers are for the highest possible advertised speeds listed on the plan.

Appendix Table 10a
Netbook Data Plans with Data Caps 2011

Country	Price per GB of Data ($PPP/GB)	Average Price per Month ($PPP)	Average Data Cap (GB)	Download Speed (Mbps)
Denmark	1.56	15.60	10.00	7.00
Estonia	2.63	39.39	15.00	1.50
Austria	3.02	34.76	11.50	8.60
United Kingdom	3.12	46.79	15.00	13.30
Lithuania	3.57	14.29	4.00	7.20
Poland	5.07	71.00	14.00	42.00
Switzerland	5.93	30.65	5.17	18.80
Italy	6.90	27.62	4.00	11.25
Luxembourg	7.69	17.22	2.24	7.20
Korea	9.05	40.73	4.50	
United States	9.14	63.99	7.00	7.30
Hungary	12.25	53.06	4.33	14.00
Turkey	14.40	43.88	3.05	13.13
Israel	20.60	20.60	1.00	
Mexico	34.42	49.91	1.45	7.20
Japan	5466.01	97.31	0.02	7.20

Note: Only 16 out of the 38 countries have limited data plans in the sample. Japan charges by the amount of packets sent, so we assumed 1 packet=1000 bytes. These prices are for the data plan only and do not include the price of the phone plan or device charge. The download speed numbers are for the highest possible advertised speeds listed on the plan.

Appendix Table 10b
Netbook Data Plans with No Data Caps 2011

Country	Average Price per Month ($PPP)	Download Speed (Mbps)
Italy	22.05	7.20
Luxembourg	24.51	
Switzerland	35.46	
Japan	97.31	7.20

Note: Only 4 out of the 38 countries have any unlimited data plans in the sample. Japan charges by the amount of packets sent, so we assumed 1 packet=1000 bytes. These prices are for the data plan only and do not include the price of the phone plan or device charge. For unlimited plans, we assume the data cap to be 30GB when calculating the per GB price. The download speed numbers are for the highest possible advertised speeds listed on the plan.

APPENDIX D: Demographics Dataset

Below is a concise version of the demographics dataset, containing only the most recent data available for the countries surveyed. A complete version containing historical data going back several years is available at http://www.fcc.gov/reports/international-broadband-data-report-third.

Community	% Households with broadband	Population Total	Population density (avg population per square meter)	GDP total (US$m), PPP (purchasing power parity)	GDP per cap, PPP (purchasing power parity)	Education (% of labor force with tertiary education)
ALA0 Australia	**73**	**22326388**	**3**	**864132**	**39369**	**23**
ALA1 New South Wales	73	7232589	9	277443	38928	34
ALA2 Victoria	72	5545932	24	201108	36924	33
ALA3 Queensland	74	4513850	3	168190	38011	28
ALA4 South Australia	69	1644582	2	54467	33529	27
ALA5 Western Australia	75	2293510	1	117195	52216	31
ALA6 Tasmania	65	507643	8	15982	31755	25
ALA7 Northern Territory	73	229711	0	11839	52336	31
ALA8 Australian Capital Territory	83	358571	153	17908	50833	47
AT0 Austria	**72**	**8375290**	**102**	**324770**	**38870**	**20**
AT11 Burgenland (A)	67	283965	78	7446	26301	16
AT12 Niederösterreich	74	1607976	85	51265	31938	16
AT13 Wien	74	1698822	4320	85127	50453	24
AT21 Kärnten	66	559315	60	18160	32394	17
AT22 Steiermark	67	1208372	74	40631	33650	16
AT31 Oberösterreich	73	1411238	121	54680	38769	16
AT32 Salzburg	73	529861	75	23443	44297	18
AT33 Tirol	69	706873	57	28817	40906	17
AT34 Vorarlberg	79	368868	146	15065	40985	16
BE0 Belgium	**70**	**10839905**	**360**	**395970**	**36824**	**38**
BE1 Région de Bruxelles-Capitale/Brussels Hoofdstedelijk Gewest	65	1089538	6861	75064	70249	45
BE21 Prov. Antwerpen	74	6251983	471	227124	36580	36
BE3 Région Wallonne	64	3498384	209	93563	26919	34
BG0 Bulgaria		**7563710**	**69**	**46112**	**6072**	

BG3 Severna I iztochna Bulgaria	32	3922971	58	17659	4488	No Data
BG4 Yugozapadna I yuzhna tsentralna Bulgaria	48	3640739	87	28453	7788	No Data
Canada	**70**			**1332626**		
CA1 Newfoundland And Labrador	70	511281	1	23125	45230	36
CA2 Prince Edward Island	72	143395	25	4110	28659	47
CA3 Nova Scotia	69	944810	18	29819	31560	48
CA4 New Brunswick	65	752838	11	24155	32086	46
CA5 Quebec	65	7905679	6	261953	33135	49
CA6 Ontario	71	13227791	15	502414	37982	56
CA7 Manitoba	59	1234535	2	44506	36051	44
CA8 Saskatchewan	65	1044028	2	52134	49936	37
CA9 Alberta	71	3720928	6	216173	58097	45
CA10 British Columbia	75	4529674	5	166636	36788	47
Yukon Territory	No data	34559	0	1911	55304	No Data
Northwest Territories, and Nunavut	No data	No data	No data	5292	No Data	No Data
Chile	39	16928873	23	177938	10511	
CL01 Tarapaca	41	307426	7	8568	27871	No Data
CII Antofagasta	64	538432	5	14867	26154	No Data
CIII Atacama	36	278515	4	4496	16143	No Data
CIV Coquimbo	26	708369	18	5522	7795	No Data
CV Valparaiso	39	1739876	106	19111	10984	No Data
CVI O'Higgins	19	874806	53	8971	10255	No Data
CVII Maule	17	999685	33	8305	8308	No Data
CVIII Bio-Bio	31	2022995	55	21778	10765	No Data
CIX Araucania	20	962120	30	5719	5945	No Data
CX Los Lagos	25	825830	17	10637	12880	No Data
CXI Aisen	22	103738	1	1444	13923	No Data
CXII Magallanes y Anta(a)rtica	33	158111	1	2995	18943	No Data
CRMS Santiago	51	6814630	442	105098	15422	No Data
CL14 Los Rios	26	378193	21	No Data	No Data	No Data
CL15 Arica Y Parinacota	53	186147	11	No Data	No Data	No Data
Cyprus	**56**	**804435**	**87**	**22246**	**27852**	
CZ0 Czech Republic	**63**	**10506813**	**137**	**268732**	**25673**	**16**
CZ01 Praha	70	1257158	2627	67972	55118	32
CZ02 Střední Cechy	65	1264978	119	28427	23099	13
CZ03 Jihozápad	61	1210751	71	26717	22155	14
CZ04 Severozápad	58	1143489	135	23826	20821	7

CZ05 Severovýchod	67	1511909	124	31370	20816	12
CZ06 Jihovýchod	66	1669223	122	38707	23282	16
CZ07 Střední Morava	57	1232042	135	25380	20575	14
CZ08 Moravskoslezsko	61	1243220	234	26334	21063	12
DK0 Denmark	**84**	**5534738**	**129**	**211487**	**38372**	**38**
DK01 Hovedstaden	86	1680271	660	77383	46552	40
DK02 Sjælland	82	820564	113	22944	27938	28
DK03 Syddanmark	80	1200277	99	41012	34187	26
DK04 Midtjylland	85	1253998	96	44815	35917	30
DK05 Nordjylland	86	579628	73	19897	34275	26
Estonia	**66**	**1340127**	**31**	**26526**	**19789**	
FI0 Finland	**81**	**5351427**	**18**	**190561**	**35777**	**40**
FI13 Itä-Suomi	78	652346	9	17366	26540	30
FI18 Etelä-Suomi	83	2672190	66	109414	41229	39
FI19 Länsi-Suomi	80	1355168	23	43320	32098	32
FI1A Pohjois-Suomi	80	643989	5	18954	29563	32
FI20 Åland	64	27734	18	1430	52099	28
France	**70**	**64694497**	**103**	**2175064**	**33800**	**31**
FR1 Île de France	77	11798427	986	646979	55081	41
FR2 Bassin Parisien	67	10743207	74	299251	27936	No Data
FR3 Nord - Pas-de-Calais	65	4025605	324	110716	27527	27
FR4 Est	70	5379468	112	152203	28412	No Data
FR5 Ouest	67	8534180	100	243813	28820	No Data
FR6 Sud-Ouest	73	6866219	66	202781	29794	No Data
FR7 Centre-Est	67	7557252	108	246093	32799	No Data
FR8 Méditerranée	72	7894822	117	234073	29769	No Data
FR 9 Departements d'outre-mer	54	No Data	No Data	No Data	No Data	No Data
DE0 Germany	**75**	**81802257**	**229**	**2951421**	**35992**	**28**
DE1 Baden-Württemberg	75	10753880	301	420143	39102	27
DE2 Bayern	75	12538696	178	521852	41714	26
DE3 Berlin	76	3460725	3895	113081	32847	34
DE4 Brandenburg	64	2503273	85	66755	26579	28
DE5 Bremen	No Data	660706	1633	32910	49734	24
DE6 Hamburg	78	1786448	2371	104081	58663	28
DE7 Hessen	79	6067021	287	265076	43728	26
DE8 Mecklenburg-Vorpommern	57	1642327	70	43561	26381	24
DE9 Niedersachsen	81	7918293	166	253287	31945	21
DEA Nordrhein-Westfalen	79	17845154	522	643844	36024	22

DEB Rheinland-Pfalz	74	4003745	201	125686	31322	23
DEC Saarland	77	1017567	394	35059	34285	19
DED Sachsen	66	4149477	224	114270	27411	31
DEE Sachsen-Anhalt	65	2335006	113	62102	26357	22
DEF Schleswig-Holstein	81	2834259	179	90479	31949	22
DEG Thüringen	72	2235025	137	59235	26328	27
GR0 Greece	**33**	**11260402**	**86**	**337965**	**30138**	**27**
GR1 Voreia Ellada	27	3580472	64	89843	25152	25
GR2 Kentriki Ellada	20	2475170	47	66125	26795	19
GR3 Attiki	46	4088447	1080	147407	36295	32
GR4 Nisia Aigaiou, Kriti	29	1116313	64	34590	31085	20
HU0 Hungary	**61**	**10014324**	**108**	**202002**	**20138**	**23**
HU10 Közép-Magyarország	69	2951436	430	99402	33978	31
HU21 Kosep-Dunantul	62	1098654	99	18451	16726	18
HU22 Nyugat-Dunantul	64	996390	88	18741	18775	16
HU23 Del-Dunantul	56	947986	67	13205	13856	17
HU31 Eszak-Magyarország	55	1209142	89	14979	12246	16
HU32 Eszak-Alfold	53	1492502	84	19585	13036	18
HU33 Del-Alfold	56	1318214	72	17638	13307	19
Iceland	**92**	**317630**	**3**	**11723**	**36706**	**31**
Ireland	**65**	**4467854**	**66**	**177606**	**39911**	
IE01 Border - Midlands and Western	60	1204423	38	33299	27766	30
IE02 Southern and Eastern	68	3263431	91	144307	44392	36
Israel		7623600	352	No Data	No Data	No Data
IL01 Jerusalem	53	934500	1431	No Data	No Data	No Data
IL02 Northern	56	1268200	284	No Data	No Data	No Data
IL03 Haifa	70	905700	1046	No Data	No Data	No Data
IL04 Central	76	1834600	1418	No Data	No Data	No Data
IL05 Tel Aviv	73	1281100	7448	No Data	No Data	No Data
IL06 Southern	69	1095600	77	No Data	No Data	No Data
IL06 Judea and Samaria	68	303900	No Data	No Data	No Data	No Data
IT0 Italy	**52**		**200**	**1950076**	**32477**	**18**
ITC1 Piemonte	51	4457335	179	153628	34659	16
ITC2 Valle d"Aosta/Vallée d"Aoste	52	128230	40	5266	41444	13
ITC3 Liguria	49	1616788	303	55925	34627	20

ITC4 Lombardia	58	9068078	396	406704	41745	17
ITD1 Provincia Autonoma Bolzano-Bozen	55	507657	69	23085	46275	11
ITD2 Provincia Autonoma Trento	58	529457	86	20281	39017	17
ITD3 Veneto	55	4937854	280	182535	37362	14
ITD4 Friuli-Venezia Giulia	56	1235808	163	44458	36117	15
ITD5 Emilia-Romagna	56	4432418	205	172742	39821	17
ITE1 Toscana	58	3749813	165	131985	35596	17
ITE2 Umbria	53	1273449	154	26830	21027	16
ITE3 Marche	56	1020458	107	51359	43237	15
ITE4 Lazio	55	5728688	338	213078	37869	22
ITF1 Abruzzo	52	1342366	126	35916	26910	18
ITF2 Molise	43	319780	73	8390	26154	17
ITF3 Campania	43	5834056	435	121803	20954	16
ITF4 Puglia	37	3698396	193	87688	21494	15
ITF5 Basilicata	44	587517	61	13787	23343	15
ITF6 Calabria	43	2011395	136	42422	21119	17
ITG1 Sicilia	42	5051075	199	107427	21324	15
ITG2 Sardegna	56	1675411	70	41695	24952	13
JP0 Japan		**128057352**	**343**	**4194818**	**32897**	**24**
JPA Hokkaido/Tohoku	53	5506419	66	156717	28458	No Data
JPB Tohoku	53	9335636	140	271668	28993	No Data
JPC Southern-Kanto	78	35618564	2717	1341994	38255	No Data
JPD Northern-Kanto, Koshin	63	10001045	283	313162	31319	No Data
JPE Hokoriku	62	5443799	166	172603	31694	No Data
JPF Toukai	67	15111223	677	530112	34940	No Data
JPG Kinki	73	20903173	797	655144	31476	No Data
JPH Chugoku	57	7563428	241	238226	31474	No Data
JPI Shikoku	52	3977282	213	112886	28292	No Data
JPJ Kyushu, Okinawa	53	14596783	334	402305	27619	No Data
KR0: Korea	**84**	**48874539**	**491**	**1425223**	**29161**	**34**
KR01: Capital region	90	24336199	2079	681747	28014	40
KR02: Gyeongnam region	78	7680036	623	248928	32412	37
KR03: Gyeonbuk region	73	5022566	252	140377	27949	34
KR04: Jeolla region	76	4893303	238	140066	28624	25
KR05: Chungcheong region	88	4952605	299	166243	33567	23

KR06: Gangwon region	74	1442929	87	35348	24497	29
KR07: Jeju	72	546901	296	12513	22879	34
Latvia	59	2229641	36	24448	10824	
Lithuania	57	3244601	52	35138	10560	
Luxembourg (Grand-Duché)	68	511840	196	41263	83613	**32**
Mexico	**21**	**112336538**	**57**	**1476530**	**13784**	20
ME01 Aguacalienetes	24	1184996	211	16249	14340	24
ME02 Baja California Norte	36	3155070	44	41520	13297	21
ME03 Baja California Sur	28	637026	9	9481	16978	23
ME04 Campeche	20	822441	14	75784	95769	20
ME05 Coahuila	7	2748391	18	43873	16774	22
ME06 Colima	134	650555	116	7793	13052	21
ME07 Chiapas	17	4796580	65	27356	6101	15
ME08 Chihuahua	4	3406465	14	45784	13561	17
ME09 Distrito Federal	35	8851080	5964	260658	29488	29
ME10 Durango	18	1632934	13	18847	12178	18
ME11 Guanajuato	68	5486372	179	56408	11207	14
ME12 Guerrerro	23	3388768	53	22021	7006	17
ME13 Hidalgo	13	2665018	128	22712	9403	15
ME14 Jalisco	4	7350682	94	93665	13401	21
ME15 Mexico	12	15175862	680	135214	9174	18
ME16 Michoacan	13	4351037	74	36481	9186	15
ME17 Morelos	26	1777227	363	16425	9845	18
ME18 Nayarit	20	1084979	39	9143	9443	20
ME19 Nuevo Leon	34	4653458	73	110754	25052	24
ME20 Oaxaca	7	3801962	41	22800	6419	15
ME21 Puebla	13	5779829	169	49377	8780	15
ME22 Queretaro	22	1827937	157	27258	15985	21
ME23 Quintana Roo	30	1325578	31	21275	16488	18
ME24 San Luis Potosi	15	2585518	42	27694	11169	21
ME25 Sinaloa	26	2767761	48	31522	11893	22
ME26 Sonora	30	2662480	15	37828	15136	21
ME27 Tabasco	12	2238603	91	50715	24796	19
ME28 Tamaulipas	25	3268554	41	46535	14661	23
ME29 Tlaxcala	9	1169936	293	7961	7062	18
ME30 Veracruz	14	7643194	106	69390	9544	18
ME31 Yucatan	20	1955577	49	21043	11017	15
ME32 Zacatecas	12	1490668	20	12965	9390	16
NL0 Netherlands	**80**	**16574989**	**492**	**679034**	**41189**	**36**

NL1 Noord-Nederland	75	1713954	206	67601	39560	26
NL2 Oost-Nederland	77	3517162	363	122140	34898	28
NL3 West-Nederland	82	7777014	901	341659	44257	34
NL4 Zuid-Nederland	79	3566859	505	140691	39551	29
NO0 Norway	**80**	**4858199**	**16**	**262945**	**56171**	**39**
NO01 Oslo og Akershus	83	1123359	225	81425	76977	46
NO02 Hedmark og Oppland	75	375925	8	15699	42232	25
NO03 Sør-Østlandet	79	928852	28	39972	44406	29
NO04 Agder og Rogaland	76	706823	30	36748	54602	30
NO05 Vestlandet	82	835517	18	43715	54083	32
NO06 Trøndelag	86	422102	11	19951	48910	34
NO07 Nord-Norge	74	465621	4	21462	46432	31
PL0 Poland	**61**	**38167329**	**122**	**721478**	**18919**	**24**
PL1 Centralny	60	7763999	145	201853	26034	No Data
PL2 Poludniowy	61	7938995	289	147604	18607	No Data
PL3 Wschodni	57	6718785	90	89915	13369	No Data
PL4 Pólnocno-Zachodni	67	6111526	92	112843	18500	No Data
PL5 Poludniowo-Zachodni	64	3907724	133	75258	19247	No Data
PL6 Pólnocny	61	5726300	95	94010	16451	No Data
PT0 Portugal	**57**	**10637713**	**116**	**265126**	**24948**	**16**
PT11 Norte	53	3741092	176	74273	19829	13
PT15 Algarve	57	437643	88	11393	26250	12
PT16 Centro (PT)	51	2375902	84	49345	20724	11
PT17 Lisboa	67	2839908	949	98985	34966	22
PT18 Alentejo	48	749055	24	16990	22550	14
PT30 Região Autónoma da Madeira (PT)	59	245811	106	5743	23405	8
PT20 Região Autónoma dos Açores (PT)	54	247568	309	8087	32689	13
RO0 Romania		**21413815**	**93**	**156019**	**7260**	
RO1 Macroregiunea unu	30	5240224	78	35755	6864	No Data
RO2 Macroregiunea doi	20	6505815	97	33346	5148	No Data
RO3 Macroregiunea trei	43	5521131	157	59016	10692	No Data

RO4 Macroregiunea patru	31	4146645	69	27766	6600	No Data
SK0 Slovakia	**55**	**5424925**	**111**	**122534**	**22640**	**17**
SK01 Bratislavský kraj	57	628686	309	34329	55129	30
SK02 Západné Slovensko	60	1866652	125	39759	21302	13
SK03 Stredné Slovensko	51	1350492	83	24352	18030	14
SK04 Východné Slovensko	51	1589443	101	24091	15198	14
Slovenia	**67**	**2046976**	**102**	**55432**	**27275**	
ES0 Spain	62	45989016	92	1476469	32217	**34**
ES11 Galicia	52	2738602	93	79028	28854	33
ES12 Principado de Asturias	62	1058114	100	31559	29803	37
ES13 Cantabria	66	577997	111	17999	31226	38
ES21 Pais Vasco	65	2138588	298	89421	41863	47
ES22 Comunidad Foral de Navarra	63	619011	60	24979	40647	39
ES23 La Rioja	58	314005	63	11137	35276	32
ES24 Aragón	63	1313017	28	46643	35504	34
ES30 Comunidad de Madrid	71	6335807	805	266688	42365	40
ES41 Castilla y León	54	2499155	27	77306	30792	34
ES42 Castilla-la Mancha	58	2035516	26	53001	26204	24
ES43 Extremadura	52	1082792	27	24267	22460	25
ES51 Cataluña	69	7301132	230	272626	37396	32
ES52 Comunidad Valenciana	60	4994322	219	142594	28566	28
ES53 Illes Balears	66	1079094	220	36685	34283	21
ES61 Andalucia	56	8206057	96	201485	24721	27
ES62 Región de Murcia	59	1460664	131	39052	27056	26
ES63 Ciudad Autónoma de Ceuta (ES)	65	74403	3893	2121	29226	25
ES64 Ciudad Autónoma de Melilla (ES)	59	72515	5508	1899	27105	25
ES70 Canarias (ES)	61	2088225	284	56771	27339	25
SE0 Sweden	**79**	**9340682**	**23**	**345848**	**37363**	**34**
SE11 Stockholm	84	2019182	314	107258	54136	38
SE12 Östra Mellansverige	79	1558292	41	49032	31724	28
SE21 Småland med öarna	75	810066	24	25800	31935	24

SE22 Sydsverige	80	1383653	100	43823	32057	32
SE23 Vastsverige	79	1866283	64	64721	34952	30
SE31 Norra Mellansverige	78	825931	13	25793	31258	23
SE32 Mellersta Norrland	73	369708	5	12660	34191	27
SE33 Övre Norrland	76	507567	3	16704	32916	29
TUR Turkey	**34**	**72561312**	**94**	**1038330**	**14519**	
UK0 United Kingdom	**80**	**62261892**	**258**	**2095021**	**33904**	**36**
UKC North East	75	2606600	305	67042	25942	26
UKD North West	80	6935700	493	197430	28622	30
UKE Yorkshire and The Humber	76	5301300	346	147181	27991	29
UKF East Midlands	83	4481400	289	132197	29699	28
UKG West Midlands	75	5455200	421	152855	28144	28
UKH Eastern	82	5831800	308	181201	31423	28
UKI London	84	7825200	5025	457137	58958	44
UKJ South East	84	8523100	450	303977	36035	34
UKK South West	85	5273700	223	161253	30825	30
UKL Wales	77	3006400	145	74559	24859	30
UKM Scotland	78	5222100	67	173943	33489	37
UKN Northern Ireland	42	1799392	128	46243	25850	32
US0 United States	68	309050816	34	14551782	47085	
US01 Alabama	56	4729656	36	172567	36486	20
US02 Alaska	73	708862	1	49120	69294	24
US04 Arizona	74	6676627	23	253609	37985	23
US05 Arkansas	52	2910236	22	102566	35243	17
US06 California	73	37266600	92	1901088	51013	27
US08 Colorado	72	5095309	19	257641	50564	32
US09 Connecticut	75	3526937	281	237261	67271	33
US10 Delaware	68	891464	176	62280	69863	25
US11 Dist. of Columbia	72	610589	3840	103288	169161	45
US12 Florida	70	18678049	134	747735	40033	24
US13 Georgia	69	9908357	66	403070	40680	25
US15 Hawaii	69	1300086	78	66760	51350	26
US16 Idaho	72	1559796	7	55435	35540	22
US17 Illinois	69	12944410	90	651518	50332	27
US18 Indiana	59	6445295	69	275676	42772	21
US 19 Iowa	68	3015766	21	142698	47317	22
US 20 Kansas	75	2841121	13	127170	44761	27
US 21 Kentucky	58	4339435	42	163269	37624	18
US 22 Louisiana	61	4529426	40	218853	48318	18
US 23 Maine	67	1312939	16	51643	39334	23

US 24 Maryland	74	5737274	227	295304	51471	32
US 25 Massachusetts	76	6631280	327	378729	57113	35
US 26 Michigan	66	9931235	68	384171	38683	23
US 27 Minnesota	71	5290447	26	270039	51043	29
US 28 Mississippi	52	2960467	24	97461	32921	17
US 29 Missouri	64	6011741	34	244016	40590	23
US 30 Montana	61	980152	3	36067	36797	24
US 31 Nebraska	69	1811072	9	89786	49576	25
US 32 Nevada	74	2654751	9	125650	47330	20
US 33 New Hampshire	78	1323531	57	60283	45547	31
US 34 New Jersey	73	8732811	455	487335	55805	32
US 35 New Mexico	58	2033875	7	79678	39175	22
US 36 New York	69	19577730	160	1159540	59228	29
US 37 North Carolina	65	9458888	75	424935	44924	24
US 38 North Dakota	71	650417	4	34685	53327	24
US 39 Ohio	64	11532111	109	477699	41423	22
US 40 Oklahoma	63	3724447	21	147543	39615	20
US 41 Oregon	75	3855536	16	174151	45169	26
US 42 Pennsylvania	67	12632780	109	569679	45095	24
US 44 Rhode Island	71	1056870	391	49234	46585	28
US 45 South Carolina	60	4596958	59	164445	35773	21
US 46 South Dakota	66	820077	4	39893	48645	23
US 47 Tennessee	60	6338112	59	254806	40202	21
US 48 Texas	67	25213445	37	1207494	47891	23
US 49 Utah	80	2830753	13	114538	40462	25
US 50 Vermont	69	622433	26	25620	41161	29
US 51 Virginia	70	7952119	78	423860	53302	31
US 53 Washington	77	6746199	39	340460	50467	28
US 54 West Virginia	59	1825513	29	64642	35410	16
US 55 Wisconsin	71	5668519	40	248265	43797	24
US 56 Wyoming	73	547637	2	38527	70351	21

Sources

	% households with broadband	Population Total	Population density	GDP total	GDP per cap, PPP	Education
Australia	2010, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2005, OECD
Austria	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Belgium	2010, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Bulgaria	2011, Eurostat	2010, Eurostat	2010, Eurostat	2009, Eurostat	2009, Eurostat	
Canada	2010, CRTC	2010, OECD	2010, OECD	2010, OECD	2010, OECD	2006, OECD
Chile	2011, Subtel	2009, OECD	2009, OECD	2009, OECD	2009, OECD	
Cyprus	2011, Eurostat	2011, Eurostat	2010, Eurostat	2009, Eurostat	2009, Eurostat	
Czech Republic	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Denmark	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Estonia	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	
Finland	2011, OECD; for Aland, 2007, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
France	2011, Eurostat	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, Eurostat
Germany	2010, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Greece	2009, OECD	2009, OECD	2009, OECD	2008, OECD	2008, OECD	2008, OECD
Hungary	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Iceland	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2006, OECD
Ireland	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Israel	2010, OECD	2010, OECD	2010, OECD			
Italy	2011, OECD	2011, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Japan	2010, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2009, OECD
Korea	2009, KCC	2010, OECD	2010, OECD	2010, OECD	2010, OECD	2006, OECD
Latvia	2011, Eurostat	2011, Eurostat	2010, Eurostat	2009, Eurostat	2009, Eurostat	
Lithuania	2011, Eurostat	2011, Eurostat	2010, Eurostat	2009, Eurostat	2009, Eurostat	
Luxembourg	2011, OECD	2011, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Mexico	2010, OECD	2010,	2010,	2009,	2009,	2008,

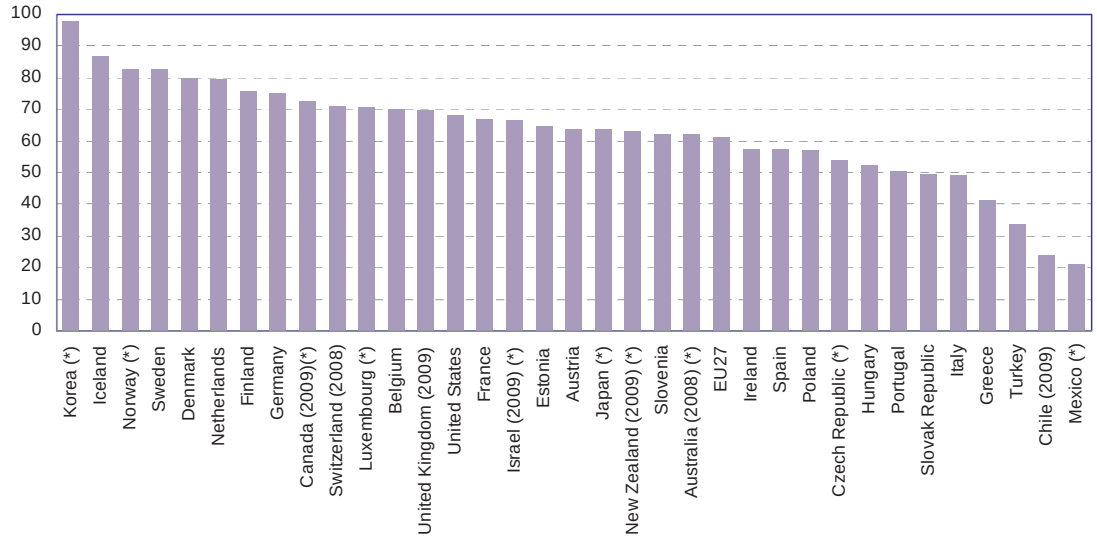
Netherlands	2010, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Norway	2011, OECD	2010, OECD	2010, OECD	2007, OECD	2007, OECD	2008, OECD
Poland	2011, Eurostat	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Portugal	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Romania	2011, Eurostat	2011, Eurostat	2010, Eurostat	2009, Eurostat	2009, Eurostat	
Slovakia	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Slovenia	2010, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	
Spain	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
Sweden	2011, OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
United Kingdom	2011, OECD; for Northern Ireland 2008 OECD	2010, OECD	2010, OECD	2009, OECD	2009, OECD	2008, OECD
United States	2010, NTIA	2010, OECD	2010, OECD	2010, OECD	2010, OECD	2008, OECD

APPENDIX E: Market and Regulatory Background

In our previous *IBDR*s, we included in Appendix E market and regulatory background information as well as information about topography and television and radio broadcast stations. Much of the information reported in Appendix E of our earlier *IBDR*s has not changed. Therefore, we incorporate by reference Appendix E from the Second *IBDR* as supplemented by the new information contained herein.

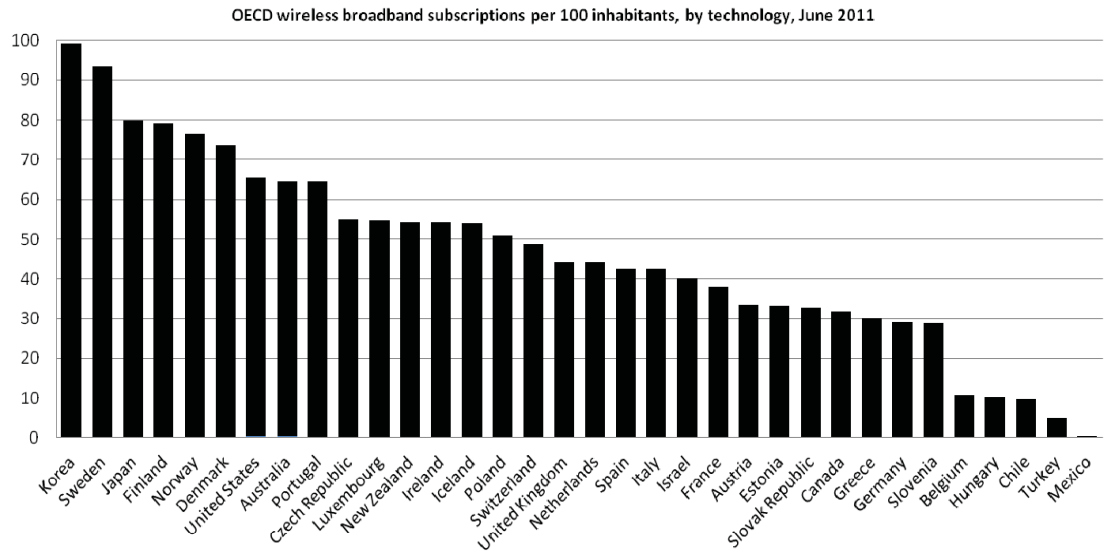
This Appendix contains updated information on regulatory and market developments for the 40 foreign countries for which we obtained either pricing data in Appendix C or community-level demographic and broadband adoption data in Appendix D. We also include in this Appendix topography and broadcast information for Israel, the one country that was not included in Appendix E in the Second International Broadband Data Report. The country-specific tables included in this Appendix E provide data on wired broadband and wireless broadband, unlike the Second International Broadband Data report, which included country-specific tables on fixed and mobile broadband. We made this change to reflect how the OECD currently reports broadband data.

Table 1
OECD Rankings, Households with Broadband Access, 2010 or latest available year
Percentage of all households
OECD Broadband Portal Table 2a



Source: OECD, ICT database and Eurostat, Community Survey on ICT usage in households and by individuals, November 2011.
Generally, data from the EU Community Survey on household use of ICT, which covers EU countries plus Iceland, Norway and Turkey, relate to the first quarter of the reference year.
For Australia: data is based on a financial year, data provided relate to the second half of the reference year and the first half of the following year; data was based on a multi-staged area sample of private and non-private dwellings, and covers the civilian population only; data includes persons aged 15 years and over except members of the permanent defense forces, certain diplomatic personnel of overseas governments customarily excluded from census and estimated population counts, overseas residents in Australia, and members of non-Australian defense forces (and their dependants) stationed in Australia.
For Canada: Statistics for 2009 include the territories (Northwest Territories, Yukon Territory and Nunavut).
For the Czech Republic, data relate to the fourth quarter of the reference year.
For Japan: Households with Internet access via FTTH, ADSL, cable and fixed wireless broadband.
For Korea: Data also include mobile [broadband] phone access.
For New Zealand: The information is based on households in private occupied dwellings. Visitor-only dwellings, such as hotels, are excluded.

Table 2
OECD Rankings, Wireless Broadband Subscriptions per 100 inhabitants, June 2011
Source: OECD Broadband Portal Table 1d(2)



1. Australia

Regulation: The Australian Competition and Consumer Commission (ACCC) has modified the deal between Telstra, the Australian government and NBN Co for Telstra to decommission its copper network and shift its customers to the new high-speed network. Telstra will now be allowed to promote its wireless service as a substitute for fiber because the ACCC felt that the original restrictions on Telstra's marketing of its wireless services could hinder competition for wireless voice and broadband services.[1] Also, as a part of the agreement with the government and NBN Co., Telstra must separate its wholesale and retail divisions. It has submitted a plan for this separation to the ACCC for approval, which the ACCC accepted in February, 2012.[2]

Market and Competition: Telstra is the only 4G provider in Australia. It launched its LTE service on the 1800 MHz network in May 2011[3], but it did not offer 4G-capable handsets until January 2012.[4] Users could only access the service using USB dongles (*i.e.*, stick modems). By March 2012, Telstra was offering two 4G handsets following the launch of Samsung's latest device loaded with the OS2.3 Android software.[5]

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[1] The Australian, *NBN loses Telstra wireless battle* (Dec. 20, 2011), *available at* http://www.theaustralian.com.au/business/in-depth/nbn-loses-telstra-wireless-battle/story-e6frgaif-1226218587235.

[2] ABC News, *ACCC green lights Telstra separation plan* (Feb. 28, 2012), *available at* http://www.abc.net.au/news/2012-02-28/accc-approves-telstra-separation-plan/3856848.

[3] The Register, *Telstra turns on* 4G (May 24, 2011), *available at* http://www.theregister.co.uk/2011/05/24/telstra_tunes_lte/.

[4] *News.com.au, Telstra first 4G smartphone hits the shelves* (Jan. 24, 2012), *available at* http://www.news.com.au/.../smartphones/...first-4g-smartphone.../story-fn6.

[5] The Register, *Samsung joins Telstra's 4G handset party* (March 26, 2012), *available at* http://www.theregister.co.uk/2012/03/26/telstra_galaxy_s_ii_4g/.

Wired	Total	Fiber	Cable	DSL	Other[6]
Fixed broadband subs per 100 inhabitants[7]	24.0	0.1	3.9	19.9	0.0
Fixed broadband subs (June 2011)[8]	5,405,000				
% of households with fixed broadband access (2008)[9]	62.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[10]	64.8				
Mobile wireless broadband subs (June 2011)[11]	14,609,000				

2. Austria

Market and Competition: In 2010, the incumbent operator, Telekom Austria, substantially accelerated the expansion of its fiber-optic cable network, reaching 1.5 million homes or 36% of all households in the country at the beginning of September 2010. The operator plans to create "fiber cities" across the country, bringing FTTH to 150,000 homes and businesses; allowing broadband connection speeds of up to 1 Gbps by 2013.[12] Telekom Austria merged with mobilkom austria in 2011 and now operates under the A1 brand.[13] In November 2011, ZTE Corporation launched a commercial LTE network in Austria in partnership with Hutchison 3G (H3G) Austria.[14]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[15]	24.7	0.1	7.6	16.9	0.0
Fixed broadband subs (June 2011)[16]	2,068,623				
% of households with fixed broadband access (2010)[17]	63.7				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[18]	33.5				
Mobile wireless broadband subs (June 2011)[19]	2,807,234				

[6] "Other" includes broadband over power lines.

[7] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[8] *Id*.

[9] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 9, 2011).

[10] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011). This figure includes satellite, which could be fixed or mobile, and terrestrial fixed wireless, which is generally not a mobile service but is included by the OECD in its mobile broadband statistics. This figure does not include mobile-broadband equipped handsets that do not subscribe to a data package for a separate fee and did not make an Internet data connection via IP in the previous three months.

[11] *Id.*

[12] IHS Global Insight, *Austria: Telecoms Report* (2010) (accessed Dec. 14, 2011), http://ihsglobalinsight.com (subscription-based service).

[13] http://www.telekomaustria.com/presse/news/02_23-pr-results-2010.php (accessed May 1, 2012).

[14] Medianama, *H3G, ZTE launch commercial LTE network in Austria* (Nov. 16, 2011), *available at* http://press-release.medianama.com/h3g-zte-launch-commercial-lte-network-in-austria-223.

[15] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 7, 2011).

[16] *Id.*

[17] OECD Broadband Portal, Table 2a (July 2010) (Dec. 7, 2011).

[18] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 7, 2011).

3. Belgium

Market and Competition: Four Belgian operators currently hold 3G licenses and competition in the market is intense. The three existing mobile operators: Belgacom's Proximus, Orange's Mobistar and KPN's BASE; were joined by a fourth 3G licensee, in a joint-venture between cable operators Telenet and Tecteo, in June 2011.[20]

At the end of November 2011, four companies acquired 4G licensees in the 2.6 GHz band: Belgacom SA, BUCD BVBA, KPN group Belgium SA and Mobistar SA; through an auction conducted by the regulator, Belgian Institute for Post services and Telecommunications (BIPT).[21]

In August 2011, BIPT announced plans to free up the existing mobile frequency bands in the 900 MHz, 1800 MHz (GSM) and 2.0 GHz (UMTS) spectrum and make them technology-neutral. BIPT has indicated it will free up the existing frequency bands being used for 2G GSM and 3G UMTS services, consistent with European Union directives, so they can be used for next-generation services like LTE. Several companies have announced plans to test LTE mobile-broadband networks in Belgium, including Telenet, Mobistar and KPN.[22]

The BIPT issued a consultation in March 2012, on the 800 MHz spectrum as part of ongoing plans to make the band available for electronic communications services in the European Union by 2013. The consultation relates to the use of the 800 MHz band for wireless broadband services. Responses and comments were due to BIPT by May 11, 2012.[23]

In July 2011, the Belgian media regulator, the Conference of Regulators of Electronic Communications (CRC) published a set of decisions that addressed triple play services (TV, Internet and fixed telephony). The new rules went into effect in August 2011 and will impact the Belgian television broadcasting landscape by opening up the cable television market in Belgium and improving the prices and quality of the services provided to the consumer.[24]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[25]	31.6	0.0	14.6	16.9	0.1
Fixed broadband subs (June 2011)[26]	3,433,746				
% of households with fixed broadband access (2010)[27]	70.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[28]	10.9				

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[19] *Id*.

[20] IHS Global Insight, *Belgium*: *Telecoms Report* (2011) (accessed Jan. 19, 2012).

[21] http://www.bipt.be/ShowDoc.aspx?objectid=3639&lang=en.

[22] *Id*.

[23] http://www.bipt.be/en/426/ShowDoc/3761/Consultations/Consultation_organised_by_the_BIPT_Council_of_21_M.aspx

[24] http://www.bipt.be/ShowDoc.aspx?objectID=3539&lang=EN.

[25] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 9, 2011).

[26] *Id*.

[27] OECD Broadband Portal, Table 2a (June 2011) (accessed Dec. 9, 2011).

Mobile wireless broadband subs (June 2011) [29]	1,182,344

4. Bulgaria

Market and Competition: Following requests from industry, Bulgaria's telecommunications regulator, the Communications Regulation Commission (CRC), reopened an auction for a fourth GSM operator in 2011, however, the auction failed to attract any bidders. Observers say that the auction failed because of the high penetration in the Bulgarian mobile market and the auction's high starting bid.[30]

In December 2011, the CRC announced the authorization of three operators to launch mobile services in the 1800 MHz range. The operators may choose their network technology, whether GSM, UMTS, LTE or WiMAX.[31]

In December 2011, the CRC also announced an auction with negotiated bidding for granting a license for a broadband wireless (BWA) concession, using 1 frequency block of 42 MHz in the 3.5 GHz range for a period of ten years. [32] The auction was held in February and the results have not yet been announced.

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[33]	14.70	Data N/A	Data N/A	Data N/A	Data N/A
Fixed broadband subs (2010)[34]	1,101,634				
% of households with fixed broadband access (2009) [35]	26				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[36]	20				
Mobile wireless broadband subs (Q1 2012)[37]	1,505,406				

5. Canada

Regulation: In November 2011, the Canadian Radio-Television and Telecommunications Commission (CRTC) issued a new ruling on billing practices for wholesale residential Internet access. To foster competition at the wholesale level, the CRTC decided that there are two acceptable methods for large

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[28] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 9, 2011).

[29] *Id*.

[30] http://sofiaecho.com/2011/11/27/1213578_bulgaria-delays-tender-for-fourth-mobile-carrier.

[31] http://www.crc.bg/news.php?news_id=180&lang=en.

[32] http://www.crc.bg/news.php?news_id=174&lang=en

[33] *See* ITU, *ICT Statistics Database* (2010), *available at* http://www.itu.int/ITU-D/icteye/Indicators/Indicators.aspx (ITU Statistics Database) (accessed Nov. 17, 2011).

[34] *Id*.

[35] *See* eGovernment Factbook (2009), *available at* http://www.epractice.eu/en/document/288394.

[36] Wireless Intelligence, https://www.wirelessintelligence.com/Index.aspx (accessed May 15, 2012) (available by subscription) (High Speed Packet Access (HSPA) connections only). HSPA, which uses the FDD transmission scheme, includes HSDPA (High Speed Downlink Packet Access), HSUPA (High Speed Uplink Packet Access) and HSPA Evolved.

[37] *Id.*

telephone and cable companies to charge independent service providers for use of their networks: the flat-rate billing model and the capacity-based billing model. Under the flat-rate model, independent service providers are charged a flat monthly fee per retail customer for access to a telephone or cable company's network. Under the capacity-based model, independent service providers pre-purchase the amount of network capacity they anticipate they will need, and if demand exceeds the amount purchased, the provider must manage its network capacity until it can buy more.[38] Under this model, the independent service providers are paying for the total capacity they need, not the volume of data downloaded. The CRTC decided to implement the capacity-based billing model for independent ISPs starting in February 2012. This decision only affects the wholesale services that the large telephone and cable companies provide to independent ISPs. Furthermore, the CRTC does not regulate the rates or packages that ISPs offer to consumers.[39]

Market and Competition: In its Telecom Regulatory Policy 2011-291, the CRTC stated that it would be in the public interest to establish universal target speeds for broadband Internet access so that all Canadians, particularly those in rural and remote areas, could benefit from a greater level of broadband connectivity. The CRTC established target speeds of 5 Mbps downstream and 1 Mbps upstream, which are to be available to all Canadians through a variety of technologies by the end of 2015.[40]

A number of technologies and platforms are available and used to provide broadband service in Canada. In 2010, mobile (HSPA+) technology was available to 96% of households, surpassing DSL (85%), fixed wireless and satellite (83%) and cable modem (82%).[41]

Rogers launched its 4G LTE broadband network in July 2011, and Bell deployed its own LTE network in September 2011.

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[42]	31.2	0.2	17.6	13.5	0.0
Fixed broadband subs (December 2011)[43]	10,653,342				
% of households with fixed broadband access (2009) [44]	72.2				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[45]	31.8				
Mobile wireless broadband subs (June 2011) [46]	10,835,371				

6. Chile

[38] http://www.crtc.gc.ca/eng/info_sht/t1044.htm.

[39] http://www.crtc.gc.ca/eng/com100/2012/r120127.htm.

[40] Canadian Radio-television and Telecommunications Commission, *Broadband Report* (November 2011), *at* http://www.crtc.gc.ca/eng/publications/reports/broadband/bbreport1111.htm.

[41] *Id*. at 7.

[42] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[43] *Id*.

[44] OECD Broadband Portal, Table 2a (June 2011) (accessed Dec. 16, 2011). In even numbered years, Canada includes only its 10 provinces in its statistics and excludes its three territories.

[45] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[46] *Id.*

Regulation: New amendments to the General Telecommunications Law passed in 2011 mandate that information regarding the service plans of Internet Service Providers (ISPs) must be transparent and prohibit ISPs from blocking arbitrary applications, services and Internet content.[47]

The Chilean government's support is a fundamental component of the country's broadband deployment. There is no universal service requirement in Chile, and the Telecommunications Development Fund is financed from the national budget rather than through levies on telecommunications operators. In 2009, the government funded a two year project to provide broadband access to between 70-90% of the rural population, called Rural Internet Network: All Chile Connected. The public-private partnership with telecommunications operator Entel and Ericsson completed the first stage of the project in September 2010 by connecting 1.7 million rural inhabitants. The second stage of the project was launched in August 2011, benefitting 991,000 people in 587 communities, and the third and final stage is expected to be completed by the beginning of 2012.[48]

In November 2011, Chile's President Sebastian Piñera signed a bill to create a Superintendency of Telecommunications, a new telecommunications regulator that will deal with more technical issues than the Subsecretaría de Telecomunicaciones (SUBTEL), the current telecommunications regulator. The Superintendency will have three major functions: to reduce the time needed to award mobile licenses; improve regulation; and supervise and measure network performance, and produce quarterly service quality indices showing the different networks' performance to help consumers make informed decisions when contracting for services. It has been tasked with: monitoring compliance with regulations and administering punitive measures when necessary; participating in the award and revocation of licenses; ensuring proper use of spectrum; and collecting information on the sector and regulating tariffs. The Superintendency will not replace the current telecommunications regulator SUBTEL, but will work alongside it. The bill has been sent to Congress for approval and is expected to be processed by the end of 2012.[49]

Market and Competition: The largest broadband provider by subscribers is Telefónica Chile (Movistar). Another major broadband provider is Claro Chile, which was created by the merger of Telmex Chile and Claro Chile in August 2010 to form a new company offering triple-play services under the Claro brand name. As of December 2011, Telefónica Chile has the most market share, at 43.5%, followed by VTR (37.9%), Claro Chile (10.1%), Grupo GTD 7.3%) and Entel (1.0%).[50]

On December 1, 2011, Chile launched an auction of 4G spectrum in the 2.6 GHz band for LTE services. The government is auctioning three blocks of 20 MHz each in the 2.6 GHz band, and a maximum of one block will be awarded for each applicant. Auction rules were made available on December 16, 2011.[51] Award of the licenses in anticipated in the second half of 2012.

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[47] Telegeography GlobalComms Database: Chile (2011) (accessed Dec. 5, 2011), http://www.telegeography.com (subscription-based service).

[48] Telegeography, *Govt, Entel and Ericsson to connect rural areas to broadband* (Dec. 7, 2010); Telegeography, *Rural roll-out reaches second stage* (Aug. 19, 2011).

[49] Telecompaper, *Chile to set up second telecoms watchdog by end-2012*, (Dec. 28, 2011); Government of Chile, *Proyecto de ley que crea Superintendencia de Telecomunicaciones*, (Nov. 4, 2011) at http://www.gob.cl/especiales/proyecto-de-ley-que-crea-superintendencia-de-telecomunicaciones/.

[50] Telegeography GlobalComms Database: Chile (2011) (April 23, 2012).

[51] Subtel, *Subtel Lanza Concurso para Servicios 4G Impulsando Mayor Cobertura y Competencia en Banda Ancha Móvel* (Dec. 1, 2011), *available at* http://www.subtel.gob.cl/prontus_subtel/site/artic/20111201/pags/20111201082958.html.

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[52]	11.0	0.0	5.3	5.7	0.0
Fixed broadband subs (June 2011)[53]	1,883,956				
% of households with fixed broadband access (2009) [54]	23.9				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[55]	9.7				
Mobile wireless broadband subs (June 2011) [56]	1,656,473				

7. Cyprus

Regulation: The Department of Electronic Communications of the Ministry of Communications and Works (MCW) oversees spectrum management.[57] The Office of the Commissioner of Electronic Communications & Postal Regulation, established in 2002, is responsible for the introduction of effective competition in the provision of networks and services, and the protection of consumers, especially in issues relevant to the price and the quality of the provided services.[58]

Cyprus requires both unbundled loops and wholesale broadband access.[59]

Market and Competition: Cytamobile-Vodafone's entire network has been upgraded to 3.5G. MTN is currently in the process of a 3.5G upgrade with priority given to the urban areas of Nicosia.[60] Using a 3G mobile phone, a 3G modem, or a specialized 3G data card, Cypriot users can access the internet with broadband speeds of up to 384 kbps or up to 1.8 Mbps in the case of 3.5G (HSDPA).

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[61]	17.62	Data N/A	Data N/A	Data N/A	Data N/A
Fixed broadband subs (2010)[62]	194,455				
% of households with fixed broadband access	Data N/A				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[63]	37				

[52] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[53] *Id*.

[54] OECD Broadband Portal, Table 2a (June 2011) (accessed Dec. 16, 2011).

[55] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[56] *Id*.

[57] *See* MCW, http://www.mcw.gov.cy/mcw/mcw.nsf/index_en/index_en?OpenDocument.

[58] *See* OCECPR, http://www.ocecpr.org.cy/nqcontent.cfm?a_id=767&tt=ocecpr&lang=gr; *see also* Cyprus Government, Office of the Commissioner of Electronic Communications and Postal Regulation, http://www.cyprus.gov.cy/portal/portal.nsf/All/6D2934F2A71AAF04C225702A0029F464.

[59] http://ec.europa.eu/information_society/policy/ecomm/doc/implementation_enforcement/annualreports/15threport/cy.pdf.

[60] http://www.cyprusbroadband.net/3g-mobile-broadband.html.

[61] ITU Statistics Database (accessed Nov. 17, 2011).

[62] *Id.*

Mobile wireless broadband subs (Q1 2012)[64]	413,367

8. Czech Republic

Market and Competition: O2 Czech Republic maintains its focus on developing attractive voice and data packages, along with the policy of migration from pre-paid to contract, on its fully-fledged 3G network. In February 2011, O2 and T-Mobile announced an agreement to share W-CDMA networks in areas served by neither. Consistent with Telefónica's group strategy, its Czech unit has begun trials of LTE as its 4G technology of choice.[65] In September 2011, the Czech Republic announced the tender for 4G spectrum in the 800 MHz, 1800 MHz and 2.6 GHz bands. Public consultation on auction rules was released in March 2012 and comments were due in May.[66] The frequencies on offer can be purchased by the existing mobile operators in order to add 4G services to their service portfolios. The 1800MHz band is reserved for a possible new entrant. Dates have not yet been established for the auction.[67]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[68]	15.1	1.9	4.7	8.5	0.0
Fixed broadband subs (June 2011)[69]	1,589,600				
% of households with fixed broadband access (2010) [70]	53.6				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[71]	54.9				
Mobile wireless broadband subs (June 2011) [72]	5,777,828				

9. Denmark

Regulation: The Danish government announced in October 2011 that the National IT and Telecom Agency (NITA) will close, and the agency's business will be transferred to the Ministry of Business Affairs and Growth, the Ministry of Defense, the Ministry of Finance and the Ministry of Interior and Economy.[73]

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[63] Wireless Intelligence, https://www.wirelessintelligence.com/Index.aspx (accessed May 15, 2012) (HSPA connections only).

[64] *Id.*

[65] IHS Global Insight, *Czech Republic: Telecoms Report (2011)* (accessed Jan. 19, 2012).

[66] Czech Telecommunication Office, *Press Release,* March 20, 2012 *available at* http://www.ctu.eu/main.php?pageid=342 (accessed May 23, 2012).

[67] http://www.ctu.cz/cs/download/aktualni_informace/invitation_to_tender_20_03_2012_invitation_to_tender_20_03_2012.pdf (accessed May 18, 2012).

[68] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[69] *Id*.

[70] OECD Broadband Portal, Table 2a June 2011) (accessed Dec. 16, 2011). Data relates to the fourth quarter of 2010.

[71] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[72] *Id.*

[73] http://en.itst.dk/news/the-national-it-and-telecom-agency-is-closing.

Market and Competition: The number of broadband connections continues to rise, and the country has had rapid growth in the number of broadband connections with speeds of up to 100 Mbps.[74] By the end of June 2011, speeds of up to 100 Mbps were available to 38% of households and businesses.[75] According to NITA, the improvement is due to the expansion of the existing fiber network in the country, as well as the upgrade of the cable network.[76]

Next generation mobile broadband is also expanding, with all four major mobile operators now holding LTE licenses.[77] In October 2011, TeliaSonera's Danish unit, Telia, announced plans to expand the coverage of its LTE network to an additional 69 cities, taking its total network coverage to 73 cities in the country, covering over half of Denmark's population.[78] Incumbent TDC partnered with Ericsson to roll out its LTE network.[79] Hutchison Whampoa's Hi3G entered into an agreement with ZTE for the delivery of LTE infrastructure equipment that will enable it to build the first LTE TDD (Time Division Duplex)/FDD (Frequency Division Duplex) dual-mode network in the world.[80]

At the end of June 2011, approximately 0.5% of all households in the country remained unable to get a connection of at least 2 Mbps, down from 1.0% a year earlier.[81] In an effort to help meet the objective of providing broadband access offering download speeds of at least 100 Mbps to all by 2020, and meet the ever increasing need for bandwidth, NITA launched a public consultation on the future shape of the 800MHz digital dividend auction.[82] In August 2011 the government announced that the frequencies in the bands 791-821 MHz and 832-862 MHz would be auctioned nationwide for telecom use on a service- and technology-neutral basis.[83] This auction is due to be held in May 2012.[84]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[85]	37.7	5.0	10.1	21.9	0.7
Fixed broadband subs (June 2011)[86]	2,090,825				
% of households with fixed broadband access (2010) [87]	80.1				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[88]	73.6				

[74] IHS Global Insight, *Denmark:* Telecoms Report (2011) (accessed Dec. 2, 2011); Telegeography GlobalComms Database: *Denmark* (2011) (accessed Dec. 2, 2011).

[75] *Id.*

[76] IHS Global Insight, *Denmark: Telecoms Report* (2011) (accessed Dec. 2, 2011).

[77] http://point-topic.com/content/operatorSource/profiles2/denmark-broadband-overview.htm.

[78] IHS Global Insight, *Denmark: Telecoms Report* (2011) (accessed Oct. 11, 2011).

[79] IHS Global Insight, *Denmark*, Telecoms Report (2011) (accessed Nov. 8, 2010); Telegeography GlobalComms Database: Denmark (2011) (accessed Oct 12, 2011).

[80] IHS Global Insight, *Denmark*: Telecoms Report (2011) (accessed Mar. 29, 2011); Telegeography GlobalComms Database: *Denmark* (2011) (accessed Mar. 29, 2011).

[81] IHS Global Insight, *Denmark:*, Telecoms Report (2011) (access March 22, 2012).

[82] *Id.*

[83] *Id.*; Telegeography GlobalComms Database: *Denmark* (2011) (accessed March 23, 2012).

[84] *Id.*

[85] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[86] *Id*.

[87] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

Mobile wireless broadband subs (December 2010) [89]	4,081,086

10. Estonia

Market and Competition: On July 23, 2010 the European Commission (EC) approved Estonia's plan to provide state aid to the Estonian Wideband Infrastructure Network (EstWin) project to roll out a nationwide broadband network by 2015.[90] This plan to develop super-fast broadband infrastructure is intended to narrow the gap in digital service provision that exists between urban and rural areas. It will do so by connecting households and business to a new fiber network capable of offering 100 Mbps speeds.[91]

The EstWin project will be implemented in several stages.[92] The first stage is the deployment of fiber-optic networks in rural areas where it is not currently commercially viable to do so.[93] Next, the project will cover the upgrade of existing networks to improve their quality and capacity.[94] Telecom operators will build network connection points in cooperation with local governments, and an open access model will be used, with all operators being able to rent the infrastructure on equal terms.[95] By the end of the project, 98% of end users will be within 1.5 kilometers of the nearest network access point.

On August 24, 2011, the government announced completion of the first stage of the EstWin project.[96]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[97]	24.1	5.5	6.1	11.9	0.6
Fixed broadband subs (June 2011)[98]	322,523				
% of households with fixed broadband access (2010) [99]	64.5				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[100]	33.3				
Mobile wireless broadband subs (June 2011) [101]	446,510				

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[88] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[89] *Id*.

[90] *Estonia Broadband Overview*, http://point-topic.com/content/operatorSource/profiles2/estonia-broadband-overview.htm

[91] *Id.*

[92] *Id.*

[93] *Id.*

[94] *Id.*

[95] *Id.*

[96] *First stage of EstWin broadband network completed*, http://www.elasa.ee/index.php?page=93&action=article&article_id=30.

[97] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[98] *Id*.

[99] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[100] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[101] *Id.*

11. Finland

Market and Competition: Finland leads the Nordic countries in mobile broadband penetration as more users migrate to LTE networks and fixed-mobile replacement.[102] Thirty percent of Finns use mobile broadband subscriptions.[103] Most of the users that acquired mobile broadband in 2011 were users who already had a fixed broadband connection.[104] The Finnish Communications Regulatory Authority (FICORA) anticipates the greatest increase in mobile broadband will continue to occur in households where it will be used side-by-by with another connection. [105]

The fastest and most affordable broadband connections – and consequently the users – were concentrated in the big cities where there is more variety in the supply of fast, fixed-line internet connections, and competition.[106] Specifically, in the Greater Helsinki area, other large cities, and areas outside of large cities, the percentages of homes with fixed-line internet connections were 40%, 30%, and 20% respectively. Big city dwellers paid 20% less for their internet connections than those living elsewhere in Finland. [107]

In order to increase the availability of broadband connections of 100 Mbps in sparsely-populated areas by the end of 2015, the state, municipalities, and the EU have agreed together to cover 66% of the cost of building ultra-high speed broadband infrastructure in those areas.[108] The first company to receive such aid is Suupohjan Seutuverkko Oy.[109] The regulator provided the aid in February 2012 for the optic-fiber network covering the municipality of Karvia in Western Finland.[110]

There is a lot of competition in the Finnish broadband market. Elisa, TeliaSonera, DNA, and Finnet are the dominant players.[111] At the end of June 2011, Elisa and TeliaSonera were the joint broadband market leaders. Each had a 30% share. DNA and Finnet Group held 19% and 16% shares of the broadband market respectively.[112]

DNA has recently taken steps to increase its market share. DNA indicated that it will achieve the higher downlink speeds via the deployment of two technologies: dual carrier HSPA+ (DC-HSPA+) and Long Term Evolution (LTE).[113] As of April 2012, DNA has the largest 4G DC-HSPA network in Finland covering over 100 cities and almost 50% of the Finnish population. Its LTE network is available in the capital city Helsinki, as well as in Turku, Tampere and Hameenlinna.[114]

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[102] IHS Global Insight, *Finland*: Telecoms Report (2011)(accessed March 21, 2012).

[103] *Id.*

[104] http://www.viestintavirasto.fi/en/index/asiointi-info/ajankohtaista/lehdistotiedotteet/2012/T_4.html.

[105] *Id.*

[106] *Id.*

[107] *Id.*

[108] http://www.viestintavirasto.fi/en/index/asiointi-info/ajankohtaista/uutiset/2012/P_9.html.

[109] *Id.*

[110] *Id.*

[111] IHS Global Insight, *Finland*: Telecoms Report (2011) (accessed March 21, 2012).

[112] *Id.*

[113] Telegeography GlobalComms Database: Finland (2011) (accessed March 21, 2012).

[114] http://telecomlead.com/inner-page-details.php?id=8337&block=Broadband (accessed May 21, 2012).

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[115]	28.9	0.7	4.8	20.8	2.6
Fixed broadband subs (June 2011)[116]	1,550,400				
% of households with fixed broadband access (2010) [117]	75.8				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[118]	79.1				
Mobile wireless broadband subs (June 2011)[119]	4,243,800				

12. France

Market and Competition: The rollout of fiber in France is picking up speed in part because operators are entering into new agreements and increasing investments. For example, in November 2011 France Telecom-Orange announced an agreement with mobile provider SFR to deploy optical fiber technology covering millions of households in less densely-populated areas of France.[120] The fiber-optic deployment agreement covers approximately 9.8 million homes in areas where both operators have redundant deployment projects. [121] This fiber investment is part of France Telecom-Orange's plan to spend, with the help of private-operator investment, EUR2 billion (US$2.7 billion) by 2015 on fiber expansion to reach 60% of French households by 2020.[122]

In addition, in September 2011, the French telecommunications regulator, ARCEP (L'Autorité de régulation des communications électroniques et des postes) sold the first blocks of 4G mobile frequencies in the 2500 – 2690 MHz band for a total of EUR936 million (US$1.28 billion).[123] ARCEP awarded concessions to all four of the country's main mobile network operators and raised far more money than it had expected.[124] However, another goal of the auction is to achieve LTE coverage across 99% of the country by 2025. Accordingly, in December 2011, ARCEP kicked off phase two of the licensing process by selling the more valuable – or so-called "golden" 800 MHz frequencies – for EUR 2.64 billion (US$3.45 billion) to Vivendi's SFR, France Telecom, and Bouygues.[125]

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[115] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[116] *Id*.

[117] OECD Broadband Portal, Table 2a (June 2011) (accessed Dec. 16 2011).

[118] OECD Broadband Portal, Table 1d (2)) (June 2011) (accessed Dec. 2, 2011).

[119] *Id.*

[120] France Telecom-Orange, SFR strike agreement to roll out fibre to less densely populated areas (Nov. 15, 2011), http://www.telegeography.com/products/commsupdate/articles/2011/11/15/france-telecom-orange-sfr-strike-agreement-to-roll-out-fibre-to-less-densely-populated-areas/index.html

[121] *Id.*

[122] *Id.*

[123] Telegeography GlobalComms Database: *France* (2011) (accessed March 23, 2012); IHS Global Insight, *France*: Telecoms Report (2011) (accessed March 23, 2012)

[124] *Id.*

[125] Telegeography GlobalComms Database: *France* (2011)(accessed March 23, 2012); IHS Global Insight, *France*: Telecom Report (2011)(accessed March 23, 2012); IHS Global Insight, France: Telecom Report (accessed April 20, 2012)
http://myinsight.ihsglobalinsight.com/servlet/cats?pageContent=art&serviceID=9663&filterID=1015&documentID=2438445&typeID=0&documentTypeId=8&src=pc ;http://www.telecomengine.com/article/french-government-raises-345-billion-4g-auction

ARCEP and a number of other entities commissioned a report from Analysys Mason on future applications and services of ultra fast broadband (UFB).[126] The 2012 report is based upon research conducted from February to July 2011. It provides forward-looking analysis by exploring the current state of the French market, comparing representative foreign markets, and analyzing the advantages of UFB compared to regular broadband. Among other things, the report found that, because of the current availability of affordable good quality access, users in France may not see any clear incentive to switch to a faster service. According to this report, it appears that those countries wanting to enable the emergence of UFB have adopted policies such as incentives, government investment, or regulatory frameworks in support of UFB and competition.[127]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[128]	33.8	0.2	2.0	31.6	0.0
Fixed broadband subs (June 2011)[129]	21,895,000				
% of households with fixed broadband access (2010) [130]	66.8				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[131]	38.2				
Mobile wireless broadband subs (June 2011) [132]	24,776,000				

13. Germany

Regulation: German implementation of the European Union's latest Electronic Communications Framework Directive, entitled the national Telecommunications Act (*Telekommunikationsgesetz* - TKG), calls for increased competition in the sector and provides for asymmetric deregulation of the market, while allowing investigations of anti-competitive behavior to be initiated at the discretion of the German regulator (*Bundesnetzagentur* – BNetzA).[133]

In early 2012, the Upper House of the German Parliament adopted various amendments to the German Telecommunications Act ("TKG Amendments") and shortly thereafter, in March 2012, after deliberation on a set of compromise amendments, the German Lower House also voted favorably on the bill. The final legislation includes: 1) broad consent requirements of the German states for revisions to the national Frequency Allocation Plan; 2) new rules and consultation requirements between the Federal government and the German states in frequency matters concerning broadcasting; and 3) an agreement in principle on the distribution of proceeds between the Federal Government and the States in case of new "digital dividend" auctions.[134]

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[126] http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1[uid]=1496&cHash=df7940c8cb

[127] *Id.*

[128] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[129] *Id*.

[130] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[131] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[132] *Id*.

[133] http://trade.gov/cs/Germany

[134] Bundesrat Bill 72/12 (adopted on 02/10/12): http://www.bundesrat.de/nn_8396/SharedDocs/Drucksachen/2012/0001-0100/72-12,templateId=raw,property=publicationFile.pdf/72-12.pdf and Bundesrat Resolution: http://www.bundesrat.de/nn_8396/SharedDocs/Drucksachen/2012/0001-0100/72-12_28B_29,templateId=raw,property=publicationFile.pdf/72-12(B).pdf (accessed May 8, 2012).

The new legislation was published in Germany's Federal Gazette and, with the exception of a provision relating to call waiting, took effect in May 2012.[135]

Market and Competition: The German Information and Communications Technology (ICT) market is currently the largest in Europe, representing 20% of the overall European Union market, and fourth largest in the world.[136] The broadband market share distribution between Deutsche Telekom AG (DT) and its competitors remained steady over the past year, with competitors able to maintain their combined market share of over 54%.[137]

Deutsche Telekom plans to complete expansion of its fiber optic network to over 20 German cities by the end of 2012, with anticipated total expenditure of between EUR40 to 50 billion (between US $53 to 66 billion). The new network architecture will make it possible to download data at speeds of up to one gigabit per second (1 Gbps) and upload it at speeds of up to 0.5 Gbps.[138]

With mobile internet usage doubling in 2011, 3G mobile penetration is expected to reach more than 60% of all German mobile subscribers by the end of 2012.[139]

Mobile data services are the fastest growing segment within the German telecommunications services market, with expected two-digit growth rates in 2012. Overall, data services are expected to reach a volume of nearly EUR6 billion (US $7.9 billion) by the end of 2012.[140]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[141]	32.6	0.2	3.8	28.5	0.1
Fixed broadband subs (June 2011)[142]	26,615,000				
% of households with fixed broadband access (2010)[143]	75.2				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[144]	29.2				
Mobile wireless broadband subs (June 2011)[145]	23,874,300				

14. Greece

Market and Competition: Greece is among the countries hardest hit by the Eurozone monetary crisis.[146] The regulator, EETT (National Telecommunications and Post Commission), has had to take a number of

[135] http://www.bgbl.de/Xaver/start.xav?startbk=Bundesanzeiger_BGBl (accessed May 9, 2012).

[136] http://www.ukti.gov.uk/home.html?guid=none.

[137] http://www.bundesnetzagentur.de/cln_1932/SharedDocs/Pressemitteilungen/EN/2011/111215_ActivityReportPostTK.html?nn=214432.

[138] http://www.cr-report.telekom.com/site11/en/co/uebersicht/index.php.

[139] http://www.bitkom.org/70928_70921.aspx.

[140] http://www.bitkom.org/70928_70921.aspx.

[141] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[142] *Id*.

[143] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[144] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[145] *Id*.

measures in return for European Union bailout loans. Among them is the sale of spectrum as part of the privatization program begun in the early part of 2011, when Greece sold off an additional 10% stake in state-owned operator OTE to Deutsche Telekom. The Greek regulator also recently raised EUR380.5 million (US$523 million) from the sale of both new and existing spectrum in the 900 MHz and 1800 MHz bands.[147] The buyers included all three existing operators, OTE's Cosmote, Vodafone Greece, and Wind Hellas.[148] The regulator issued the licenses for 15 years.[149] It is expected that all three operators will promote the development of high speed mobile broadband technologies such as LTE.[150]

Greece's operators are also struggling to stay afloat as subscriber numbers remain far below what they had been in previous years.[151] A planned merger between Greece's second and third largest cellular companies, Wind Hellas and Vodafone, was abandoned by Vodafone.[152]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[153]	20.8	0.0	0.0	20.7	0.0
Fixed broadband subs (June 2011)[154]	2,349,878				
% of households with fixed broadband access (2010) [155]	41.2				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[156]	30.0				
Mobile wireless broadband subs (June 2011) [157]	3,391,905				

15. Hong Kong Special Administrative Region of the People's Republic of China

Regulation: In June 2011, the Legislative Council passed the Communications Authority (CA) Bill, which established a unified regulator for the entire communications industry.[158] To form the CA, the Office of the Telecommunications Authority (OFTA) and the Broadcasting Division of the Television and Entertainment Licensing Authority (TELA) were merged. The executive arm is now a government department named the Office of the Communications Authority (OFCA), similar to OFTA but with additional jurisdiction over broadcasting. The CA began functioning on April 2, 2012 and will enforce the

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[146] Telegeography GlobalComms Database: *Greece* (2011) (accessed March 23, 2012).

[147] IHS Global Insight, *Greece*: Telecoms Report (2011) (accessed March 23, 2012); IHS Global Insight, Greece: Telecoms Report (2011)(accessed March 23, 2012).

[148] *Id.*

[149] *Id.*

[150] *Id.*

[151] Telegeography GlobalComms Database: *Greece* (2011)(accessed March 23, 2012).

[152]http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/telecoms/9063386/Vodafone-quits-Hellas-merger-over-Greek-default-fears.html (accessed April 26, 2012)

[153] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[154] *Id*.

[155] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[156] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[157] *Id.*

[158] Legislative Council, *Brief on Communications Authority Bill*, *available at* http://www.legco.gov.hk/yr09-10/english/bills/brief/b33_brf.pdf. *See also* CEDB, *Press Release*, "Communications Authority Bill to be introduced" (June 18, 2010), *available at* http://www.cedb.gov.hk/ctb/eng/press/2010/pr18062010.htm.

Telecommunications Ordinance, the Broadcasting Ordinance, and the Unsolicited Electronic Messages Ordinance.[159]

In addition, the Legislative Council is considering a Competition Bill that is still in the process of being amended amidst heavy industry lobbying. The Competition Bill would repeal or amend, as applicable, any relevant competition provisions in the Telecommunications and Broadcast Ordinances. The Competition Bill would also establish a Competition Commission, which would have concurrent jurisdiction over competition-related telecommunications and broadcast matters with the CA.[160]

Market and Competition: Mobile broadband is extremely popular and demand is growing: mobile data usage for the month of December 2010 was 296 MB per 2.5/3G mobile user, a nearly threefold increase over the prior year, and almost 14 times the amount used in 2008.[161] CSL Limited launched Hong Kong's first 4G LTE mobile broadband network in November 2010.[162] PCCW and Hutchison launched their 4G joint venture in early 2011.[163]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[164]	30.16	Data N/A	Data N/A	Data N/A	Data N/A
Fixed broadband subs (2010)[165]	2,126,962				
% of households with fixed broadband access (2012) [166]	87				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[167]	70				
Mobile wireless broadband subs (Q1 2012)[168]	5,027,667				

16. Hungary

Market and Competition: The market consists of three mobile network operators: Deutsche Telekom's T-Mobile, Telenor Hungary, and Vodafone, which are increasingly battling over mobile data revenues.

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[159] OFCA, "Chairman's Welcome Message" (April 1, 2012), *available at* http://www.coms-auth.hk/en/about_us/message/index.html.

[160] *See* Secretary of CEDB, *Remarks on the Competition bill* (Oct. 18, 2011), *available at* http://www.info.gov.hk/gia/general/201110/18/P201110180243.htm (detailing six proposed amendments to the Competition Bill); *see also* Mayer Brown JSM, *Hong Kong Antitrust & Competition Update* (Dec. 21, 2010), *available at* http://www.mayerbrown.com/publications/article.asp?id=10169 (noting that Mayer Brown is "assist[ing] a broad range of organizations who are making submissions to the Bills Committee").

[161] *2010 Government Yearbook, id.* at 358.

[162] CSL, *Press Release*, "CSL Launches World's First Commercial Grade LTE/DC-HSPA+ Network" (November 25, 2010), *available at* http://www.hkcsl.com/en/pdf/2010/CSL_Network_Launch_eng.pdf.

[163] Telegeography GlobalComms Database: *Hong Kong* (2011)(accessed March 23, 2012).

[164] ITU Statistics Database, accessed Nov. 17, 2011.

[165] *Id.*

[166] http://www.gov.hk/en/about/abouthk/factsheets/docs/telecommunications.pdf (accessed May 1, 2012).

[167] Wireless Intelligence, https://www.wirelessintelligence.com/Index.aspx (accessed Apr. 14, 2011) (HSPA connections only).

[168] *Id.*

To that end, each operator has been focusing on mobile broadband, with significant investments in high speed packet access (HSPA+). Specifically, Telenor and T-Mobile launched their HSPA+ networks in 2011, while third operator Vodafone launched its network in early 2010.[169] In addition, T-Mobile plans to launch LTE in 2012.[170]

The three network operators may soon face additional competition. In August 2011, Hungary's national telecoms regulator, the National Media and Infocommunications Authority (NMHH), launched an auction for companies wishing to secure the right to use 900 MHz mobile frequencies for 15 years.[171] The NMHH invited bids through a two-round auction process to award three blocks of spectrum in the 900 MHz band for the provision of GSM, UMTS, WiMAX, or LTE services. [172] NMHH received bids from six companies. In addition to the three incumbent mobile network operators, the regulator received an application to bid for 900MHz frequency blocks from a consortium of three state-owned companies (postal operator Magyar Posta, power utility MVM and development bank MFB) that are collectively referred to as MVM.[173] NMHH also received applications from Romania-based cable company RCS&RDS, and Vietnamese telecommunications company Viettel Group.[174] NMHH rejected the latter two applications, and in January 2012, awarded the 900 MHz spectrum to the MVM consortium and the three incumbents, Vodafone, Telenor and T-Mobile.[175] The incumbents have since filed multiple legal challenges to the regulator's decision to award frequencies to the new market entrant, which were pending as of April 2012.[176]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[177]	20.3	2.6	9.3	8.4	0.0
Fixed broadband subs (June 2011)[178]	2,031,947				
% of households with fixed broadband access (2010) [179]	52.2				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[180]	10.5				
Mobile wireless broadband subs (June 2011) [181]	1,046,405				

17. Iceland

Market and Competition: Although broadband adoption in Iceland remains among the highest in the world, in January 2009, Iceland suffered a severe economic collapse and the telecommunications sector

[169] IHS Global Insight, *Hungary*: Telecoms Report (2011) (accessed March 23, 2012).

[170] *Id.*

[171] Telegeography GlobalComms Database: *Hungary*(2011) (accessed March 23, 2012).

[172] *Id.*

[173] Telegeography GlobalComms Database: *Hungary* (2012) (accessed May 18, 2012)

[174] Telegeography GlobalComms Database: *Hungary* (2011) (accessed March 23, 2012).

[175] TeleGeography GlobalComms Database: *Hungary* (2012) (accessed May 18, 2012).

[176] *Id.*

[177] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[178] *Id*.

[179] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[180] OECD Broadband Portal, Table 1d (2(June 2011) (accessed Dec. 2, 2011).

[181] *Id*.

was not immune from the fallout. The two leading players, Vodafone Iceland and incumbent Síminn, continue to experience reductions in revenue as customers continue to reign in their discretionary spending.[182] Nonetheless, the industry has shown remarkable resiliency. The Post and Telecom Administration reports that in 2010, fiber-optic connections increased significantly, and there are now more than 10,000 homes connected through fiber-optic facilities. In addition, Iceland added two GSM systems that cover the whole country, and a 3G system that reaches 90% of the country's households and coastal waters.[183]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[184]	33.6	4.4	0.0	29.3	0.0
Fixed broadband subs (December 2010)[185]	106,896				
% of households with fixed broadband access (2010) [186]	87.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[187]	54.21				
Mobile wireless broadband subs (December 2010) [188]	172,127				

18. Ireland

Market and Competition: The Commission for Communications Regulation (ComReg) has been working on ushering in a new era of advanced wireless services including fast, high capacity mobile broadband.[189] On March 16, 2012, ComReg announced that it had decided to offer via auction, the rights to use spectrum across 800 MHz, 900 MHz, and 1800 MHz radio bands for the period from 2013 to 2030.[190] In all, 28 blocks of bandwidth will be made available which will more than double the currently licensed assignments in these bands. [191]

The completion of Ireland's National Broadband Scheme (NBS) in October 2010 brought broadband services to every district in the country. However, there are still some areas that, because of difficulty in reaching them or for technical reasons, have not benefited from the NBS. Consequently, in May 2011, the Irish government announced a new plan to bring broadband connectivity to the entire country by the end of 2012.[192] ComReg began 2012 with a consultation to identify the remaining individual premises in rural regions that are still not connected, [193] and remedies for next generation access.[194] ComReg also

[182] 31 May 2011: *Statistics report on the Icelandic telecommunications market in 2010,* http://www.pfs.is/default.aspx?cat_id=112&module_id=220&element_id=3213.

[183] 18 Aug 2011 *Post- and Telecom Administration Annual report for 2010*, http://www.pfs.is/default.aspx?cat_id=112&module_id=220&element_id=3299.

[184] OECD Broadband Portal, Table 1d (1) (December 2010) (accessed Nov. 15, 2011).

[185] *Id*.

[186] OECD Broadband Portal, Table 2a (July 2010) (accessed Feb. 11, 2011).

[187] OECD Broadband Portal, Table 1d (2) (December 2010) (accessed Nov. 15, 2011).

[188] *Id*.

[189] IHS Global Insight, *Ireland: Telecoms Report* (2011) (accessed March 23, 2012).

[190] 16 March 2012: *ComReg Decision on the Release of the 800 MHz, 900 MHz, and 1800 MHz spectrum bands*, http://www.comreg.ie/publications/comreg_publishes_decision_on_the_release_of_the_800_mhz__900_mhz_and_1800_mhz_spectrum_bands.583.104064.p.html.

[191] *Id.*

[192] IHS Global Insight, *Ireland: Telecoms Report* (2011) (accessed March 23, 2012).

[193] *Id.*

published another consultation on April 4, 2012, on the proposed regulation of next generation access markets.[195]

ComReg reports that most of Ireland's users subscribe to packages providing broadband speeds between 2 Mbps – 10 Mbps, but adoption of higher advertised broadband speeds is on the rise.[196] Thus, in the second quarter of 2011, contracts for broadband speeds of greater than 10 Mbps increased at the expense of lower category speeds.[197] In total, approximately 12.5% of broadband subscriptions were faster than 10 Mbps, compared to 7.3% a year earlier.[198]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[199]	21.5	0.1	5.1	16.3	0.0
Fixed broadband subs (June 2011)[200]	962,120				
% of households with fixed broadband access (2010)[201]	53.7				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[202]	47.1				
Mobile wireless broadband subs (June 2011)[203]	2,105,739				

19. Israel

Regulation: Israel's Ministry of Communications was established as a separate and distinct ministry in 1971, to cover both telecommunications and the post. The Postal Authority began to operate outside of the Ministry in 1987. Bezeq, the Israeli Telecommunications Company, was separated from the Ministry and incorporated in 1984. All regulatory responsibility lies with the Ministry of Communications. The Ministry has 5 divisions: Engineering and Licensing, Frequency Allocation, Broadcasting, Cable Television, and Computer Communications (Telematics).

The Ministry's responsibilities include: formulating telecommunications regulation and policy, developing telecommunications infrastructures, supervising Bezeq and other telecommunications service providers, supervising the Postal Authority, setting and auditing postal and communications tariffs, managing the electromagnetic spectrum, regulating and supervising cable television services and tariffs, and approving usage of telecommunications equipment in Israel.[204]

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[194] 4 April 2012: ComReg, *Next Generation Access (NGA) Proposed Remedies for NGA* Markets, http://www.comreg.ie/publications/next_generation_access_nga__proposed_remedies_for_nga_markets.583.104068.p.html.

[195] http://www.comreg.ie/about_us/comreg_publishes_its_consultation_on_the_proposed_regulation_of_next_generation_access_markets.43.1088.whatsnew.html.

[196] 14 September 2011: ComReg *Quarterly Report Q2 2011*, http://www.comreg.ie/publications/comreg_quarterly_report_q2_2011.583.103931.p.html.

[197] *Id.*

[198] *Id.*

[199] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[200] *Id*.

[201] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[202] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[203] *Id*.

[204] Israel Ministry of Communications: *http://www.moc.gov.il/135-en/MOC.aspx.*

Market and Competition: Internet penetration is growing quickly. Internet in Israel is provided through the phone and cable infrastructures, by Bezeq and HOT Telecommunication Systems Ltd respectively. Bezeq provides dial-up and ADSL services, while HOT provides cable Internet services and multi-channel TV. Due to competition laws, every ADSL or cable Internet user has to pay separately to the infrastructure provider and to the ISP. There are five major ISPs currently serving both the narrowband and broadband Internet access market. There are also 70 smaller internet service providers in the Israeli broadband market. Fixed-line incumbent, Bezeq launched its ADSL service in 2001. Bezeq remains the largest broadband-service provider in Israel, with over 1 million subscribers as of April 2012.[205] Three cable companies, Golden Channels, Matav and Tevel, launched broadband services in 2002 and now offer a combined service through their joint venture HOT.

Israel has a well developed mobile market and all three of its cellular providers, Cellcom, Partner Communications, and Pelephone, offer 3G services. Each was awarded a UTMS license in 2001 but did not begin offering services until 2004. Cellcom launched its 3G service in June 2004, and differentiated itself from the other 3G operators in Israel by providing music content services over mobile. As of 2009, it holds 26.1% of the Israeli 3G market. Pelephone, a subsidiary of Bezeq, launched 3G services in September 2004, and by 2009, had the highest 3G market share at 40.3%. Partner launched its 3G services in December 2004 and held 33.7% of the 3G market by 2009. Partner is planning to implement HSDPA technology (3.5G), which allows download speeds of up to 3.6 MB per second.[206]

Other Media: The state broadcasting network, operated by the Israeli Broadcasting Authority (IBA), broadcasts on two channels, one in Hebrew and the other in Arabic. There are five commercial channels, including a channel broadcasting in Russian, a channel broadcasting Knesset proceedings and a music channel supervised by a public body. Multi-channel cable and satellite TV packages provide access to foreign channels. IBA broadcasts on eight radio networks with multiple repeaters and Israeli Defense Forces Radio broadcasts over multiple stations. There are about 15 privately-owned radio stations, with overall more than 100 stations and repeater stations operating as of 2008.[207]

Topography: Israel covers approximately 20,700 square kilometers (7,992 sq. mi), an area slightly larger than New Jersey. Israel's geography is diverse, with desert conditions in the south, and snow-capped mountains in the north. The Negev Desert comprises approximately 12,000 square kilometers, more than half of Israel's total land area.[208]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[209]	24.2	0.0	10.0	14.3	0.0
Fixed broadband subs (June 2011)[210]	1,847,000				
% of households with fixed broadband access (2009)[211]	66.3				
Wireless					
Mobile wireless broadband subs per 100 inhabitants (June	40.3				

[205] http://www.itu.int/ITU-D/ict/newslog/CategoryView,category,Mobile%2Bsubscribers.aspx.

[206] IHS Global Insight, *Israel*: *Telecoms Report* (2011) (accessed March 23, 2012).

[207] CIA Factbook, https://www.cia.gov/library/publications/the-world-factbook.

[208] *Id.*

[209] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 5, 2011).

[210] *Id*.

[211] OECD Broadband Portal, Table 2a (accessed Dec. 5, 2011).

2011)[212]	
Mobile wireless broadband subs (June 2011) [213]	3,068,443

20. Italy

Market and Competition: In September 2011, Italy's 4G auction garnered EUR3.95 billion (over US$5.2 billion), exceeding the Ministry of Economic Development's maximum forecast of EUR3.1 billion. All four of Italy's leading wireless operators won spectrum. Telecom Italia and Vodafone each spent EUR1.26 billion for 2 blocks of 800 MHz spectrum, 1 block of 1800 MHz spectrum, and 3 blocks of 2600 MHz spectrum. Wind paid EUR1.09 billion for 2 blocks of 800 MHz spectrum and 1 block of 1800 MHz spectrum. Three Italia (3Italia) paid EUR305 million for 1 block of 1800 MHz spectrum and 4 blocks of 2600 MHz spectrum.[214]

The operators will be able to use the 1800 MHz band by the end of 2011, the 2600 MHz band at the end of 2012, and the 800 MHz band at the end of 2013. All licenses run until 2029.[215]

Telecom Italia is continuing pre-commercial 4G trials. All four operators who won spectrum plan to roll out 4G in 2012. 3Italia has announced that it plans to be the first to launch 4G in 2012. In 2013, Vodafone plans a "massive launch" and Wind plans to launch in "all major cities."[216]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[217]	22.3	0.5	0.0	21.8	0.0
Fixed broadband subs (June 2011)[218]	13,507,951				
% of households with fixed broadband access (2010) [219]	48.9				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[220]	42.4				
Mobile wireless broadband subs (June 2011) [221]	25,644,685				

21. Japan

Market and Competition: The focus of the broadband market in recent years is on fiber, which continues to be the dominant broadband technology in the country and a key driver for overall growth in broadband services. In the competitive mobile broadband market, NTT DoCoMo is the leader followed by KDDI and Softbank Mobile.

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[212] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 5, 2011).

[213] *Id.*

[214] See Ministry of Economic Development website, www.sviluppoeconomico.gov.it. (accessed December 6, 2011)

[215] See Telecom.Paper website, http://www.telecompaper.com/news/italy-raises-eur-39-billion-in-spectrum-auction. (accessed December 6, 2011).

[216] See Telegeography Globalcomms Database, *Italy*: (accessed December 7, 2011).

[217] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[218] *Id*.

[219] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[220] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[221] *Id*.

Japanese mobile carriers have begun preparing for migration to 4G LTE. The Ministry of Internal Affairs and Communications allocated spectrum in the 1.5 GHz band to NTT DoCoMo, KDDI, and SoftBank Mobile, and in the 1.7 GHz band to EMOBILE.[222] DoCoMo launched its service in December 2010, KDDI plans to begin service in December 2012, EMOBILE expects to launch LTE services in 2012. Softbank Mobile will launch its HSPA service in July 2012.[223]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[224]	27.0	16.4	4.5	6.0	0.0
Fixed broadband subs (June 2011)[225]	34,360,672				
% of households with fixed broadband access (2010)[226]	63.4				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[227]	80.0				
Mobile wireless broadband subs (June 2011)[228]	101,869,228				

22. South Korea

Market and Competition: The Korean government has encouraged companies to invest heavily in the locally-developed mobile WiMax technology called WiBro (Wireless Broadband). Since KT Corporation (KT), formerly Korea Telecom, started WiBro service in June 2006, it has invested more than KRW800 billion (US$685 million) to set up networks in Seoul and its vicinity. The service is now available nationwide, however, the technology has not been readily adopted by Korean consumers and at the end of June 2010, KT's WiBro network had only 330,000 subscribers.[229] Nevertheless, KT still plans to update its WiBro service to 10 Mbps connection speeds.[230] LTE service began in Korea in July 2011, and as of April 2012, there were 4 million subscribers. SK Telecom had 2.09 million subscribers, LG Uplus had 1.71 million, and KT had 400,000. Both SK Telecom and LG Uplus offer nationwide LTE data services.[231] LTE connections are expected to reach 10 million by 2015.[232]

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[222] IHS Global Insight, *Japan: Telecoms Report* (2011) (accessed March 23, 2012).

[223] *See* Softbank, Press Release, "Allocation of 900 MHz 'Platinum Band.'" (March 1, 2012) *available at* http://www.softbankmobile.co.jp/en/news/press/2012/20120301_01/; *see also* Ericsson, Press Release, "SOFTBANK Mobile deploys 900 MHz Evolved HSPA network (March 22, 2012) *available at* http://www.ericsson.com/thecompany/press/releases/2012/03/1596253.

[224] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[225] *Id*.

[226] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[227] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[228] *Id*.

[229] Telecoms Korea, *2010 Top 5 Korea Telecom Market News Spotlights*, January 3, 2010, *available at* http://www.telecomskorea.com/opinion-8624.html. Asia-Pacific Business and Technology Report, Super-Fast 4G Wireless Service Launching in South Korea, October 10, 2011, available at http://www.biztechreport.com/story/1619-super-fast-4g-wireless-service-launching-south-korea.

[230] Asia-Pacific Business and Technology Report, *Super-Fast 4G Wireless Service Launching in South Korea*, October 10, 2011, *available at* http://www.biztechreport.com/story/1619-super-fast-4g-wireless-service-launching-south-korea.

[231] Telecompaper.com, *LTE subs in Korea hit 4 million*, April 19, 2012, *available at http://www.telecompaper.com/news/lte-subs-in-korea-hit-4-million*

[232] Wireless Intelligence, *Over 90% of users connected to wireless internet in South Korea,* Oct. 20, 2011, *available at* http://www.wirelessintelligence.com/analysis/pdf/2011-10-20-over-90-of-users-connected-to-the-wireless-internet-in-south-korea.pdf.

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[233]	36.0	20.4	10.4	5.3	0.0
Fixed broadband subs (June 2011)[234]	17,604, 503				
% of households with fixed broadband access (2009)[235]	83.8				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[236]	99.3				
Mobile wireless broadband subs (June 2011)[237]	48,542,393				

23. Latvia

Market and Competition: In November 2011, the European Commission approved a support scheme in Latvia worth around LVL71.5 million (US$139 million) for the deployment of superfast broadband networks. The program aims to bring Internet access at speeds from 30 Mbps to 100 Mbps to both consumers and businesses, while it also hopes to further bridge the digital divide between rural and urban areas.[238]

Competitors to the incumbent carrier, Apollo (Lattelecom), include Telekom Baltija, Baltkom, Latnet, Izzi (formerly Telia Multicom), and Vernet. In June 2011, Latvijas Mobilais Telefons (LMT) launched 4G/LTE service.[239]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[240]	19.31	Data N/A	Data N/A	Data N/A	Data N/A
Fixed broadband subs (2010)[241]	434,876				
% of households with fixed broadband access	Data N/A				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[242]	18				
Mobile wireless broadband subs (Q1 2012)[243]	406,137				

[233] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[234] *Id*.

[235] KCC. The data for Korea available in the OECD Broadband Portal Table 2a (97.5%) includes mobile broadband access.

[236] OECD Broadband Portal, Table 1d (2) June 2011) (accessed Dec. 2, 2011). (terrestrial fixed wireless not included).

[237] *Id*.

[238] *See* Europa.com, http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/1323&type=HTML (accessed December 7, 2011).

[239] *See* Teliasonera website, http://www.teliasonera.com/en/media/press-releases/2011/6/teliasonera-first-with-4g-in-latvia/ (accessed December 7, 2011).

[240] ITU Statistics Database (accessed Nov. 17, 2011).

[241] *Id*.

[242] Wireless Intelligence, https://www.wirelessintelligence.com/Index.aspx (accessed May 15, 2012) (HSPA connections only).

[243] *Id.*

24. Lithuania

Regulation: In March 2011, the Lithuanian Parliament and Prime Minister approved an Information Society Development Program for 2011-2019, to be coordinated by the Ministry of Transport and Communications. The Program's priorities include increasing the public's skill in using ICT for development, promoting the use of content and services, and developing infrastructure. The program sets specific targets such as increasing the percentage of the population who regularly use the Internet from 58% in 2010 to 75% by 2015 and 85% by 2019. Another target is to increase access to broadband from 80% of the population in 2011 to 100% in 2019, to increase the number of households subscribing to broadband from 49% in 2011 to 80% in 2019, and to increase the number of state and local government agencies that engage in electronic document exchange to 100 percent.[244]

Market and Competition: Teo LT, the leading fixed telephony provider, serves 39% of broadband subscribers, followed by mobile providers Omnitel (13%) and Bitė (9%).[245]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[246]	20.58	Data N/A	Data N/A	Data N/A	Data N/A
Fixed broadband subs (2010)[247]	684,057				
% of households with fixed broadband access	Data N/A				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[248]	19				
Mobile wireless broadband subs (Q1 2012)[249]	610,769				

25. Luxembourg

Regulation: Luxembourg adopted a law implementing most of the European Union's Digital Agenda in January 2011. The Digital Agenda's aims include creating a single European digital market, improving standards-setting and interoperability, improving cybersecurity, increasing download speeds, and enhancing skills.[250]

Market and Competition: In September 2011, the largest broadband provider, state-owned PT Luxembourg, served 67% of Luxembourg's 161,000 subscribers.[251]

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[244] Resolution 301, On Lithuania's information society development program for the year 2011-2019, Seimas of the Republic of Lithuania, www.lrs.lt (accessed December 9, 2011).

[245] Report on the Electronic Communications Sector, Q2 2011, http://www.rrt.lt/download/14833/reportpercent202011%20i%20quarter.pdf (accessed Dec. 8, 2011).

[246] ITU Statistics Database (accessed Nov. 17, 2011).

[247] *Id*.

[248] Wireless Intelligence, https://www.wirelessintelligence.com/Index.aspx (accessed May 15, 2012) (HSPA connections only).

[249] *Id.*

[250] *See* European Commission, Digital Agenda for Europe, http://www.ec.europa.eu (accessed Dec. 9, 2011).

[251] *See* www.ilr.public.lu (accessed December 9, 2011).

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[252]	31.7	0.2	2.9	28.5	0.1
Fixed broadband subs (June 2011)[253]	160,639				
% of households with fixed broadband access (2010) [254]	70.3				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[255]	54.3				
Mobile wireless broadband subs (June 2011) [256]	276,679				

26. Mexico

Regulation: In an effort to strengthen ICT access and development, the Secretaría de Comunicaciones y Transportes (SCT) launched a national digital agenda (Agenda Digital.mx)[257] in March 2012 with concrete goals and actions by the government to be taken in the short term.
Some of the goals to be met by 2015 include providing 55% of Mexican homes with at least 5 Mbps broadband access; having fixed and mobile broadband penetration exceed 38 subscribers per 100 inhabitants, universal access by the end of the decade; and having all primary schools, public health centers and public offices connected to the Internet.

The digital agenda has six main lines of action: (1) implement strategies to continue increasing Internet penetration in the country, promoting competition in the telecommunications market and supporting a social coverage policy; (2) use ICT as a tool for equity and social inclusion; programs, plans and policies must bear in mind the necessary conditions to provide ICT access to the low-income segment, indigenous groups, people with disabilities, the elderly and women; (3) increase the use of new technologies in education to promote the development of digital skills; (4) use ICT to increase connectivity in the health sector, promote telemedicine initiatives and create appropriate systems for the management of healthcare centers; (5) increase the country's competitiveness through strategies aimed at promoting work skills and productivity through the digital media; and (6) consolidate e-government with new technologies that simplify administrative procedures and coordinate systems between the three branches of the federal government.

Market and Competition: ADSL continues to be the most popular form of Internet access, followed by cable, other technologies (such as dedicated access, ISDN, satellite), and dial-up.[258]

According to OECD's broadband statistics for June 2011, Mexico's broadband penetration (both fixed and wireless) continue to be among the lowest in the OECD countries, while its broadband prices in terms of cost per megabit per second are among the highest.

In the wireless broadband sector, there are four national cellular services providers, Telcel, Movistar, Iusacell and Nextel Mexico with 3G licenses. As of June 2011, Telcel led the mobile market with 70.3% market share, followed by Movistar (21.6%), Iusacell (4.4%) and Nextel Mexico (3.7%).[259] Nextel

[252] OECD Broadband Portal, Table 1d (3) (June 2010) (accessed Feb. 11, 2011).

[253] *Id*.

[254] OECD Broadband Portal, Table 2a (July 2010) (accessed Feb. 11, 2011).

[255] OECD Broadband Portal, Table 1d (2) (December 2010) (accessed Nov. 15, 2011).

[256] *Id*.

[257] *See* Agenda Digital Nacional, at http://www.agendadigital.mx/descargas/AgendaDigitalmx.pdf.

[258] Telegeography GlobalComms Database: *Mexico* (2011)(accessed Dec. 5, 2011).

[259] *Id.*

Mexico was the sole bidder in the June 2010 auction for a nationwide concession in the 1700 MHz spectrum, and was awarded the license in October 2010 despite several attempts by competitors, in particular Iusacell, to block the award.[260] Nextel's 3G network deployment, originally planned to be completed by the second quarter of 2012, has been delayed to the third quarter of 2012, due to problems in construction sites and delays in equipment delivery.[261] 2012.

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[262]	10.9	0.0	2.1	8.7	0.1
Fixed broadband subs (June 2011)[263]	11,753,458				
% of households with fixed broadband access (2010)[264]	21.1				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[265]	0.5				
Mobile wireless broadband subs (June 2011)[266]	525,508				

27. Netherlands

Regulation: Beginning in January 2013, the Independent Post and Telecommunications Authority of the Netherlands (OPTA) will be merged with the Netherlands Consumer Authority and the Netherlands Competition Authority. The merged authority will be called the Netherlands Authority for Consumers and Markets (ACM), and will retain independent status. The ACM will focus on three main themes: consumer protection, industry-specific regulation, and competition oversight.[267]

Market and Competition: KPN is the largest player in the fixed-line broadband market, serving approximately 42% of the market, followed by Ziggo with approximately 27% and UPC with approximately 12%. DSL subscribership, which currently reaches 55% of the market, has been gradually declining since early 2010, while cable subscribership has gradually risen to its current 42%. Fiber commands a small but rapidly growing share (currently less than 1%) of the broadband market.[268]

The government of the Netherlands plans to auction off a number of blocks of spectrum in 2012, including frequencies in the 800 MHz band suitable for 4G mobile data services. The Ministry of Economy may reserve a significant portion of the spectrum for new entrants.[269] Cable provider Ziggo, which purchased spectrum in 2010, launched its mobile broadband service in July 2011, targeting tablet

[260] *Id*. *See also* Total Telecom, Mexican Mobile Operators End Spectrum Dispute, Dec. 6, 2011 at http://www.totaltele.com/view.aspx?C=1&ID=469748.

[261] RCRWireless Americas, *NII Holdings to delay 3G launch; posts weak Q4 revenue; EBITDA*, Feb. 24, 2012 at http://www.rcrwireless.com/americas/20120224/carriers/nii-holdings-to-delay-3g-launch-posts-weak-q4-revenue-ebitda/.

[262] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[263] *Id*.

[264] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[265] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[266] *Id*.

[267] See OPTA news release, October 4, 2011, "New Dutch regulator to be called ACM, the Netherlands Authority for Consumers and Markets. Merger of three regulators to be completed January 1, 2013" at www.opta.nl/en/.

[268] See OPTA Market Figures for the Second Quarter of 2011 at www.opta.nl/en/.

[269] See Telegeography Comms Update September 16, 2011, "Dutch government looking to ring fence spectrum for new entrants."

and laptop users.[270] After purchasing spectrum in April 2010, Tele2 launched the first 4G network in the Netherlands in July 2010.[271]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[272]	38.5	1.3	16.0	21.2	0.0
Fixed broadband subs (June 2011)[273]	6,392,000				
% of households with fixed broadband access (2010)[274]	79.5				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[275]	44.1				
Mobile wireless broadband subs (June 2011)[276]	7,318,000				

28. New Zealand

Regulation: In April 2011, New Zealand's government implemented its Rural Broadband Initiative (RBI) by signing agreements with Telecom New Zealand and Vodafone for a NZ$285 million (US$213.9 million) infrastructure roll out. The RBI will focus on the 16% of the population living in areas that experience no or very poor broadband services. The RBI will bring high speed broadband to 252,000 customers and 86% of rural houses and businesses will have access to broadband peak speeds of at least 5 Mbps. Under the program, most rural schools will have access to speeds of 100 Mbps with 1035 rural schools connecting directly to fiber networks, and 57 schools having point to point wireless connections capable of speeds of 10 Mbps or more.[277] In the first year of the RBI, 520 schools were connected, as were 10 health facilities.[278]

Market and Competition: In August 2011, the Ministry of Economic Development (MED) announced plans for an auction of mobile spectrum in the 700 MHz band, ahead of the switch-off of analog TV signals in the country in 2013. MED has indicated that 112 MHz will be made available in the 700 MHz band. Detailed plans for the auction have not been released, which is scheduled for the fourth quarter 2012.[279] In the interim, New Zealand Telecom will conduct live customer trials of LTE in the second half of 2012 and has begun upgrading is network from 3G to 4G.

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**

[270] See Telegeography Comms Update July 19, 2011, "Ziggo enters mobile broadband sphere."

[271] See Tele2 launches the Blackberry solution in the Netherlands at press.rim.com.

[272] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[273] *Id*.

[274] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[275] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[276] *Id*.

[277] New Zealand Ministry of Economic Development. *Rural Broadband Initiative FAQ, available at* http://www.med.govt.nz/sectors-industries/technology-communication/fast-broadband/rural-broadband-initiative/faqs

[278] New Zealand Ministry of Economic Development. *Roll-Our Schedule, .available at* http://www.med.govt.nz/sectors-industries/technology-communication/fast-broadband/rural-broadband-initiative/roll-out-schedule

[279] New Zealand Ministry of Economic Development. *Digital Dividend: Planning for New Uses of the 700 MHz Band. Available at* http://www.rsm.govt.nz/cms/policy-and-planning/projects/digital-dividend-planning-for-new-uses-of-the-700-mhz-band

Fixed broadband subs per 100 inhabitants[280]	26.0	0.1	1.5	24.4	0.0
Fixed broadband subs (June 2011)[281]	1,138,830				
% of households with fixed broadband access (2009) [282]	63.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[283]	54.3				
Mobile wireless broadband subs (June 2011) [284]	2,380,709				

29. Norway

Market and Competition: Telenor continues to be the leading broadband Internet access provider in Norway, although its market share in September 2011 had fallen to 49.7%. Mobile broadband subscription continues to grow, increasing 33.7% in 2010 from 2009.[285] Fixed broadband growth slowed to 3% from the first half of 2010 to the first half of 2011, compared to 5% between the first half to 2009 to the first half of 2010.[286]

In February 2011, NetCom, Norway's second largest mobile operator, expanded its 4G network beyond Oslo to three other major cities. When its 4G network is complete, NetCom plans to offer 4G coverage to 89% of the population. In October 2011, Telenor announced the completion of upgrades to its mobile network and plans to use the upgraded network for deployment of LTE services in 2012.[287]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[288]	34.9	5.7	10.3	18.7	0.1
Fixed broadband subs (June 2011)[289]	1,703,817				
% of households with fixed broadband access (2010) [290]	82.6				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[291]	76.4				
Mobile wireless broadband subs (June 2011) [292]	3,732,917				

30. Poland

[280] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[281] *Id*.

[282] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[283] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[284] *Id.*

[285] IHS Global Insight, *Norway: Telecoms Report* (2011) (accessed Dec. 5, 2011).

[286] NPT, *The Norwegian Electronic Communications Services Market 1st half 2011* (rev. Nov. 14, 2011), *available at* http://www.npt.no/ikbViewer/Content/133773/The%20Norwegian%20Electronic%20Communcations%20Services%20market%201st%20half%202011.pdf.

[287] Telegeography GlobalComms Database, *Norway*: (2011) (accessed March 23, 2012)

[288] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[289] *Id*.

[290] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[291] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[292] *Id*.

Regulation: In March 2010, the Office of Electronic Communications (UKE) announced the inauguration of a nationwide project to support the expansion of broadband Internet access networks. Through the European Union's Rural Development Plan 2007-2013, Poland has access to a maximum of approximately 1 billion Euros (US$1.34 billion) in state and European Union funding for building broadband networks.[293]

In May 2010, the Polish Parliament passed the Act on Supporting the Development of Telecommunication Services and Networks. The purpose of the Act is to establish the legal basis for universal access to telecommunications services through new technologies, in particular broadband access, and to facilitate investment and remove barriers to telecommunications infrastructure as well as to improve the disbursement of EU funds for broadband development.[294]

Market and Competition: Mobyland (owned by Aero2) and CenterNet launched the world's first commercial LTE network in the 1800 MHz band in September 2010, aiming to cover 75% of the population. Polkomtel, Poland's largest mobile telecommunications operator by subscribers, was the latest operator to launch LTE services in December 2011, covering approximately 22% of the population.[295]

In Poland, the 2.6 GHz band and the 700/800 MHz bands are earmarked for LTE services, but the tender for the frequencies, which was originally scheduled for 2010-2011, will be delayed until 2013-2014 as the military, which uses spectrum in the 2.6 GHz band, is unable to release the spectrum before then.[296]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[297]	14.3	0.3	4.7	7.8	1.5
Fixed broadband subs (June 2011)[298]	5,460,186				
% of households with fixed broadband access (2010)[299]	56.8				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[300]	50.9				
Mobile wireless broadband subs (June 2011)[301]	19,453,493				

31. Portugal

Regulation: In January 2011, in response to a request submitted by the Portuguese government, the EU Commission approved EUR106.2 million (US$ 142.5 million) in state aid to support the deployment of

[293] Telegeography GlobalComms Database: Poland (2011) (accessed Dec. 5, 2011).

[294] 2010-2011 Joint Project of the ITU- Telecommunication Development Bureau and the Poland Ministry of Infrastructure, *New Legislative Paradigm Fostering Development of Broadband Infrastructure: Case Study – Poland*, *available at* http://www.itu.int/ITU-D/eur/NLP-BBI/CaseStudy/CaseStudy_POL.html.

[295] Telegeography GlobalComms Database: *Poland* (2011)(accessed Dec. 5, 2011).

[296] IHS Global Insight, *Poland: Telecoms Report* (2011) (accessed Dec. 5, 2011).

[297] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[298] *Id*.

[299] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[300] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[301] *Id*.

high-speed broadband networks in Portugal. The project aims to provide broadband coverage to at least 50% of the population in the 139 underserved or uncovered rural municipalities by 2013.[302]

Market and Competition: As of September 2011, Portugal Telecom continued to lead in market share for broadband services at 50%, followed by Zon Multimedia with 33.8%, Cabovisão with 8.2%, Vodafone with 4% and Sonaecom with 3.7%.[303]

As of December 2010, ANACOM, the telecommunications regulator, assessed that the number of mobile network subscribers who were eligible to use 3G services had increased to just under 10.5 million, representing 63.7% of the national wireless subscriber market. Of that total, however, only 30% actually utilized 3G technology.[304]

In November 2011, Portugal launched auctions for 4G licenses in the 450 MHz, 800 MHz, 900 MHz, 1.8 GHz, and 2.6 GHz bands. Portugal Telecom, Sonaecom and Vodafone all won spectrum that they plan to use for deployment of LTE services.[305]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[306]	20.3	1.6	8.3	10.3	0.0
Fixed broadband subs (June 2011)[307]	2,155,056				
% of households with fixed broadband access (2010) [308]	50.3				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[309]	64.7				
Mobile wireless broadband subs (June 2011) [310]	6,885,232				

32. Romania

Regulation: In the second half of 2012, the National Authority for Management and Regulation in Communications (ANCOM), the Romanian telecommunications regulator, will auction spectrum for four licenses in the 800 MHz and 2.6 GHz bands for LTE.[311]

In June 2011, Romania's Ministry of Communications and Information Society (MCSI) said it would use EU funding of EUR86.2 million (US$124 million) to fill gaps in broadband coverage. These funds were to help address the 10% of the Romania's population that is not covered by existing broadband networks.[312] In November 2011, however, MCSI said the funding would be delayed until late 2012.[313]

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[302] European Commission, State Aid SA.30317 Portugal - *High Speed Broadband in Portugal*, Jan. 19, 2011, available at http://ec.europa.eu/competition/state_aid/cases/236635/236635_1199063_71_2.pdf.

[303] Telegeography GlobalComms Database: *Portugal* (2011)(accessed Dec. 5, 2011).

[304] *Id*.

[305] IHS Global Insight, *Portugal: Telecoms Report* (2011)(accessed March 23, 2012).

[306] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[307] *Id*.

[308] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[309] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[310] *Id*.

[311] IHS Global Insight, *Romania: Telecoms Report(2011)* (accessed March 23, 2012).

[312] IHS Global Insight, *Romania* : Telecoms Report(2011)(accessed March 23, 2012).

Market and Competition: Orange Romania plans to extend its 43.2 Mbps-capable HSPA+ network to the cities of Cluj to the northwest, Constanta to the southeast, Iasi to the northeast and Timisoara to the west. Its 21.6 Mbps HSPA+ network now reaches 20 cities. At the 14.4 Mbps level, Orange Romania aims to increase its population coverage from 82.7% currently to 98% of the population by mid-2012.[314] Vodafone Romania is also planning to add mobile data coverage to all locations where it offers mobile voice, thus boosting mobile data coverage from the current 90% levels.[315]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[316]	13.96	Data N/A	Data N/A	Data N/A	Data N/A
Fixed broadband subs (2010)[317]	3,000,000				
% of households with fixed broadband access	Data N/A				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[318]	23				
Mobile wireless broadband subs (Q1 2012)[319]	4,834,782				

33. Singapore

Regulation: In November 2011, Singapore's Parliament amended the Telecommunications Act to strengthen the authority of its independent regulator, the Infocomm Development Authority (IDA). One of the amendments gives the Minister for Information, Communications and the Arts – to whom IDA reports – the power to impose a Separation Order for the transfer of telecommunications assets or business of a licensee to a separate entity. This is to eliminate barriers to competition, particularly when one operator controls the network infrastructure as well as participates in retail services. Other amendments permit the minister to issue Special Administrative Orders to allow the takeover of a telecommunications service or property by a third party. This is to ensure that a key telecommunication service remains functional, for public and national interest, in cases of insolvency by an operator. The amendments also allow the IDA to impose higher penalties, and to suspend or cancel a license if penalties are not paid on time.[320]

Market and Competition: SingTel continues to be the dominant carrier for both fixed and mobile broadband services with 45.2 and 45.5% market shares, respectively.[321] With respect to mobile services, all three operators have launched 4G LTE services. M1 launched its 4G LTE network across the

(. . . continued from previous page)

[313] *Id.*

[314] *Id.*

[315] *Id.*

[316] ITU Statistics Database (accessed Nov. 17, 2011).

[317] *Id*.

[318] Wireless Intelligence, https://www.wirelessintelligence.com/Index.aspx (accessed May 15, 2012) (HSPA connections only).

[319] *Id.*

[320] Newschannelasia.com, *Parliament passes amendments to Telecommunications Act*, November 21, 2011, *available at* http://www.channelnewsasia.com/stories/singaporelocalnews/view/1166737/1/.html

[321] Point Topic, Broadband Operator Profile, (April 2, 2012) *available at* http:// point-topic.com/content/operatorSource/profiles2/singtel.htm.

enterprise sector in June 2011.[322] SingTel began commercial operations of its LTE services at the end of 2011 and StarHub has been running LTE trials and expects to launch commercial services by the end of 2012.[323]

In 2006, the government of Singapore announced its Next Generation National Infocomm Infrastructure (Next Gen NII) plan, which proposed to upgrade the country's fixed and mobile network infrastructures to offer speeds of up to 1 Gbps and 1 Mbps, respectively by 2012.[324] As of January 2012, the Next Gen NII broadband network (NGNBN) had been deployed to 86% of the country, and is on track to achieve its target of 95% coverage by mid-2012. Also in January 2012, there were 100,000 NGNBN subscribers. Homeowners and businesses which are connected to the NGNBN can subscribe to over 40 fiber-based broadband access plans offered by 12 retail service providers.[325]

Singapore's next generation wireless infrastructure, branded Wireless@SG, offers everyone free wireless access in high volume pedestrian areas, including the Central Business District, downtown shopping belts and residential town centers. As of May 2012, the service averaged 15.1 hours per user per month, with over 5,000 public hotspots across the country. Wireless@SG will be free until March 31, 2013.[326]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[327]	24.72	Data N/A	Data N/A	Data N/A	Data N/A
Fixed broadband subs (2010)[328]	1,257,400				
% of households with fixed broadband access (2010)[329]	82				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[330]	71				
Mobile wireless broadband subs (Q1 2012)[331]	3,743,001				

[322] The Straits Times. *M1 launches 4G network today.* June 21, 2011. *Available at* http://www.straitstimes.com/BreakingNews/Singapore/Story/STIStory_682132.html.

[323] StarHub News Release, *Starhub selects Nokia Siemens network for 4G, GSM modernization, April 10, 2012 available at* http://www.starhub.com/content/corporate/newsroom/2012/04/starhub-selects-nokia-siemens-network-for-4G--gsm-moderization.html.

[324] *See* Singapore InfoComm Development Authority. *Fact Sheet: Updates to the Next Generation National Infocomm Infrastructure*, *available at* http://www.ida.gov.sg/doc/Programmes/Programmes_Level2/Annex_2.pdf *and Fact Sheet (March 2012): Next Generation Nationwide Broadband Network, available at* http://www.ida.gov.sg/images/content/Infrastructure/nbn/images/pdf/NextGenNBNFACTSHEET.pdf

[325] Singapore InfoComm Development Authority. *Fact Sheet (March 2012): Next Generation Nationwide Broadband Network, available at* http://www.ida.gov.sg/images/content/Infrastructure/nbn/images/pdf/NextGenNBNFACTSHEET.pdf.

[326] Singapore InfoComm Development Authority. *Fact Sheet (May 2012):* Wireless@SG, *available at* http://www.ida.gov.sg/doc/News%20and%20Events/News_and_Events_Level2/20090728165354/WirelessSG_factsheet.pdf.

[327] ITU Statistics Database (accessed Nov. 17, 2011).

[328] *Id*.

[329] http://www.ida.gov.sg/Publications/20070822125451.aspx.

[330] Wireless Intelligence, https://www.wirelessintelligence.com/Index.aspx (accessed Apr. 14, 2011) (HSPA connections only).

[331] *Id.*

34. Slovak Republic

Regulation: In September 2011, the Slovakian parliament passed updates of the country's telecommunications law in accordance with EU directives. Changes include allowing for the provision of 3G services in the 900 MHz band and the implementation of mobile number portability.[332]

The Telecommunications Regulatory Authority of the Slovak Republic (Telekomunikačný úrad Slovenskej republiky or TÚSR), is planning an auction of 800 MHz and 2.6 GHz spectrum in May 2012.[333] TÚSR is considering including conditions on covering areas without broadband access, as well as reserving blocks of spectrum in the 900 MHz and 1800 MHz bands for a new, fourth operator. [334]

Market and Competition: In July 2011, Telefónica Slovakia launched 3G services providing W-CDMA/HSPA coverage to approximately 33% of the population. Its 3G services are offered in mobile data plans, with the basic package offering speeds from 512 kbps, while extended packages offer speeds of up to 1,024 kbps.[335] In September 2011, T-Mobile Slovakia increased coverage of its HSPA+ network to 83 cities and municipalities. In November 2011, Orange Slovensko also upgraded its mobile network to HSPA+. Download speeds on Orange's high-end data packages have increased to 21 Mbps, while a further premium plan enables speeds of up to 42 Mbps.[336] Fixed-line operators are also upgrading their networks to address increased data demand. In October 2011, DSL competitor Slovanet expanded its 40 Mbps broadband network to cover Turčianske Teplice, a small town in central Slovak Republic.[337]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[338]	13.5	4.0	1.9	7.5	0.0
Fixed broadband subs (June 2011)[339]	731,652				
% of households with fixed broadband access (2010) [340]	49.4				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[341]	32.9				
Mobile wireless broadband subs (June 2011) [342]	1,785,534				

35. Slovenia

Market and Competition: Mobile broadband band coverage in Slovenia is below EU average, however, Mobitel, a subsidiary of fixed line operator Telekom Solvenije, initiated testing of an LTE network in the

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[332] IHS Global Insight, *Slovakia: Telecoms Report (2011)* (accessed March 23, 2012).

[333] Telecom Paper, *Slovakia plans cap on 800, 1800 MHz band holdings* (March 13, 2012) *available at* http://www.telecompaper.com/news/slovakia-plans-cap-on-800-1800-mhz-band-holdings.

[334] IHS Global Insight, *Slovakia: Telecoms Report (2011)* (accessed March 23, 2012).

[335] IHS Global Insight, *Slovakia: Telecoms Report (2011)* (accessed December 19, 2011).

[336] *Id.*

[337] IHS Global Insight, *Slovakia: Telecoms Report, (October 2011)*(accessed December 19, 2011).

[338] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[339] *Id*.

[340] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[341] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[342] *Id*.

1800 MHz band in June 2011. The test network was deployed in parts of Ljubljana on extra 1800 MHz spectrum released specifically for testing. Mobitel also plans to upgrade and expand its HSPA network to 21 Mbps, with a further upgrade to dual-carrier HSPA+ (DC-HSPA). Once fully operational, Mobitel plans to roll out LTE and LTE advanced networks across three spectrum bands the 800 MHz, 1800 MHz and 2600 MHz bands.[343] Si.Mobil, Slovenia's second largest mobile operator completed the expansion of its 3.0/3.5G network in early 2012. Si.Mobil 3G mobile services now cover 90% of the Slovenian population. However, its recently deployed base stations already support HSPA+ and DC-HSPA that allow data rates of up to 42 Mbps and the company plans to deploy more LTE ready base stations in 2012.

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[344]	23.5	3.5	6.3	13.7	0.1
Fixed broadband subs (June 2011)[345]	480,785				
% of households with fixed broadband access (2010)[346]	62.0				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[347]	28.9				
Mobile wireless broadband subs (June 2011) [348]	591,908				

36. Spain

Regulation: The assignment of spectrum has been one of the main ICT policy priorities in Spain. In early 2011, the Spanish authorities assigned spectrum to wireless providers, through a combination of auctions and comparative selection procedures on a technological and service neutral basis. In August, nine of the 11 bidders approved by the government to participate in its auction of mobile spectrum (totaling 270 MHz) were awarded frequencies.[349]

By the end of 2014, Spain's plans include a reallocation of the upper part of the UHF band (790 – 862 MHz) which will be made available for advanced communication services.[350] In addition, the Spanish telecommunications regulator, Comision del Mercado de las Telecommunicaciones has recently proposed extending the scope of the current radio spectrum regulations that permit spectrum trading, to the main frequency bands allocated for mobile services.[351]

Market and Competition: The economic outlook for Spain has worsened over the last year, as it remains beset by high unemployment and fiscal retrenchment. While this affected the ICT sector, slowing the previous acceleration of growth in both the broadband and mobile areas in recent months, there are still signs that the sector is still relatively robust.[352]

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[343] IHS Global Insight: *Slovenia: Telecoms Report (2011)* (accessed Jan. 19, 2012).

[344] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[345] *Id*.

[346] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[347] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[348] *Id.*

[349] http://www.cmt.es/cmt_ptl_ext/SelectOption.do?nav=publi_estudios.

[350]http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/regulatory/es_reg_dev_2011.pdf.pdf.

[351]http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/regulatory/es_reg_dev_2011.pdf.pdf.

[352] http://www.minetur.gob.es/telecomunicaciones/ProgramaMarco/Paginas/index.aspx (accessed March 21, 2012).

The latest subscriber data published by Spain's four main mobile operators, Telefonica, Vodafone, Orange and Yoigo show there were 56.8 million mobile subscribers in Spain in 2011. This represents a 3.4% annual increase, with a total of 807,000 new subscribers being shared between the four largest operators.[353] The issuance of new spectrum – including spectrum in the 2.6 GHz band – is helping operators cater to increased demand for data services.

In terms of broadband deployment, DSL is expected to remain the dominant fixed broadband technology, though mobile broadband connections are predicted to account for an increasing share of the overall market over the next five years. Spain has continued its commitment (as specified under its national broadband strategy, "*Plan Avanza*") to provide public aid for broadband, with a collective EUR200 million (US $263 million) allocated in 2010 and 2011 in subsidies and interest-free loans.[354]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[355]	23.7	0.2	4.5	19.0	0.0
Fixed broadband subs (June 2011)[356]	10,933,389				
% of households with fixed broadband access (2010) [357]	57.4				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[358]	42.4				
Mobile wireless broadband subs (June 2011) [359]	19,542,586				

37. Sweden

Regulation: The Swedish Post and Telecommunication Authority (PTS) conducted a survey in 2010 to measure variations in broadband availability at various speed thresholds in Sweden as a whole and in Swedish municipalities. The results reported that nearly 100% of the population has access to broadband download speeds of 3 Mbps, and 42% can access 50 Mbps service.[360]

Market and Competition: In June 2011, the four largest providers of mobile and fixed broadband were TeliaSonera (serving 37% of subscribers), Telenor (24%), Tele2 (21%), and Hi3G (16%). Together they represented 98% of all broadband subscriptions.[361]

In November 2011, TeliaSonera announced that it had expanded its 4G LTE mobile broadband services into 161 municipalities. TeliaSonera's goal is to offer LTE to 663 municipalities by the end of 2012 by augmenting its existing 2600 MHz LTE frequencies with 800 MHz and 1800 MHz bands won in spectrum auctions in March 2011 and October 2011, respectively.[362]

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[353] http://www.cmt.es/cmt_ptl_ext/SelectOption.do?nav=publi_anuales&detalles=09002719800b092f&pagina=1.

[354] http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/regulatory/es_reg_dev_2011.pdf.pdf.

[355] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[356] *Id*.

[357] OECD Broadband Portal, Table 2a (Novemebr 2011) (accessed Dec. 16 , 2011).

[358] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[359] *Id*.

[360] See PTS statistics portal, broadband survey at http://www.statistik.pts.se/broadband/index.html (accessed December 13, 2011.)

[361] See PTS Report, The Swedish Telecommunications Market first half-year 2011, November 7, 2011 at http://www.pts.se/upload/Rapporter/Tele/2011/svtelem-halvar-2011-21-eng.pdf.

[362] Telia's LTE reaches 161 cities, November 14 2011, Telegeography GlobalComms Database.

Tele2 and Telenor Sweden formed an equal joint venture to build a fourth-generation network under the name Net4Mobility in 2009. Commercial LTE-based mobile broadband services were launched over the Net4Mobility network in November 2010. Net4Mobility plans to expand coverage to 99% of the population by the end of 2012. Telenor's 4G services are now available in 116 municipalities throughout Sweden, while Tele2's commercial LTE footprint covers 60% of the population. Both Tele2 and Telenor are also augmenting existing 2600MHz LTE coverage with 800MHz and 1800MHz frequency bands won in March 2011 and October 2011 respectively.[363]

Similar to its competitors, Hi3G won 800 MHz spectrum in the March 2011 auction. In early 2012, Hi3G Sweden selected ZTE to install base stations in order to expand its 3G and 4G network infrastructure. 4G services will be available by the end of 2012.[364]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[365]	31.9	9.0	6.3	16.5	0.1
Fixed broadband subs (June 2011)[366]	2,995,000				
% of households with fixed broadband access (2010) [367]	82.6				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[368]	93.6				
Mobile wireless broadband subs (June 2011) [369]	8,778,000				

38. Switzerland

Regulation: In February 2012, the Swiss Federal Communications Commission (ComCom), auctioned spectrum in several frequency bands, including 800 MHz digital dividend spectrum (for which current licenses expire in 2013), 900 and 1800 MHz spectrum (some bands are available now, while others will be available by January 2016), and 2.1 and 2.2 GHz (available now, except for currently licensed UMTS licenses which expire at the end of 2016). Three companies won licenses: Orange, Sunrise, and Swisscom. The licenses expire at the end of 2028.[370]

Market and Competition: At the end of 2010, ten percent of Swiss households had access to broadband via fiber optic facilities.[371] Swisscom is continuing its trials of 4G (LTE) technology in seven tourist

[363] LTE Advanced tests reported by Tele2, Telenor, Telegeography, May 11 2012.

[364]ZTE deploys 3G/4G infrastructure for Hi3G, Global Telecoms Business, May 9 2012.

[365] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[366] *Id*.

[367] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[368] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[369] *Id*.

[370] *See* ComCom "Orange, Sunrise and Swisscom purchase mobile radio frequencies at auction" at http://www.comcom.admin.ch/aktuell/00429/00457/00560/index.html?lang=en&msg-id=43520 (site accessed April 25, 2012).

[371] *See* CommComm Annual Report, 2010, http://www.comcom.admin.ch/org/00452/index.html?lang=en (site accessed April 25, 2012).

areas through mid-2012, and plans to use its experience in the trials to deploy LTE, beginning later in 2012.[372]

Wired	Total	Fiber	Cable	DSL	Other
Fixed broadband subs per 100 inhabitants[373]	38.3	0.2	10.6	27.2	0.3
Fixed broadband subs (June 2011)[374]	2,983,281				
% of households with fixed broadband access (2008)[375]	70.8				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[376]	48.7				
Mobile wireless broadband subs (June 2011)[377]	3,795,353				

39. Turkey

Regulation: Beginning in 2003, the Prime Ministry and State Planning Organization's Information Society Department began an e-Transformation Project. The overall project goal was defined as promoting information society polices to increase Turkey's competitiveness. The project's focus was to develop policy actions and strategies to enable Turkey to transition to an Information Society.[378] A new Turkish media law went into effect on March 3, 2011 (Law No. 6112 on the Establishment of Radio and Television Enterprises and Their Broadcasts, or the "Law"), which repeals the pre-existing Law No. 3984 and introduces substantive changes to television and radio broadcasting in Turkey. The new regulatory regime, whose stated purpose was to respond to current technological developments and to align Turkish legislation with commitments to the EU, stipulates a complete switchover from analog to digital broadcasting by 2014. Plans for the digital dividend have not been announced.[379]

Market and Competition: Turkish regulator, the Information and Communication Technologies Authority (BTK), reported that the country's broadband sector has been one of the fastest growing communications segments with annual growth rate of 16% as of the end of the third quarter of 2011.

Turkcell is the dominant mobile operator in Turkey with 86% of the market. Turkcell's new products and marketing approaches, such as its online TV service and a promotion which allows customers to sample its Internet service free of charge for the first two months before having to commit to subscribe, have helped maintain its position.[380]

Competition has heated up as Turkey has implemented regulatory reform as part of the European Union accession program. Naked DSL offerings made available in early 2011 have increased broadband

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[372] *See* http://www.swisscom.com/en/ghq/media/mediareleases/2011/12/20111208_MM_LTE-Pilotprojekt.html (accessed April 25, 2012).

[373] OECD Broadband Portal, Table 1d (1) (December 2010) (accessed Nov. 15, 2011).

[374] *Id*.

[375] OECD Broadband Portal, Table 2a (July 2010) (accessed Feb. 11, 2011).

[376] OECD Broadband Portal, Table 1d (2) (December 2010) (accessed Nov. 15, 2011).

[377] *Id*.

[378] http://broadbandtoolkit.org/Case/tr/2

[379] http://www.chadbourne.com/files/Publication/f7967d58-3521-41da-a47d-02e34dac6446/Presentation/PublicationAttachment/d74f2cf7-78b5-4e99-9e70-05b015243b13/Turkish_MediaLaw_ca(yuksel).pdf

[380] IHS Global Insight: *Telecoms Analysis: Turkey: Telecoms Report(2011)* (accessed March 23, 2012).

penetration. Although ADSL still represents the majority of broadband subscriptions, the market is evolving as mobile broadband is growing rapidly. In addition, SuperOnline, a subsidiary of the country's largest mobile operator Turkcell, launched FTTH services at the end of 2009, collecting around 200,000 subscribers during the first year.[381]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[382]	10.0	0.3	0.5	9.2	0.0
Fixed broadband subs (June 2011)[383]	7,315,418				
% of households with fixed broadband access (2010) [384]	33.7				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[385]	5.0				
Mobile wireless broadband subs (June 2011) [386]	3,640,563				

40. United Kingdom

Regulation: In December 2010, the government issued a broadband strategy, *Britain's superfast broadband future*, allocating £530 million (US$826 million) to ensure that a digital divide based on broadband speed does not emerge between urban and rural areas. The strategy sets a goal to make the UK's broadband network the best in Europe by 2015. The UK will use a composite index to determine whether this goal is met, including factors such as speed, coverage, price and choice.[387] In order to reach the broadband goal, the UK's Department for Culture, Media and Sport (DCMS), responsible for broadband policy and delivery, aims to ensure that superfast broadband reaches 90% of households by 2015.[388] In March 2012, the DCMS announced it had chosen the super-connected cities, which will receive funding to bring superfast broadband to 1.7 million households.[389]

In January 2012, Ofcom, the independent regulator and competition authority for the UK communications industry, updated its proposal to auction 4G spectrum in the 800 MHz and 2.6 GHz bands. Final auction design is scheduled to be complete in the summer of 2012 and to extend 4G coverage requirements to 98% of the UK. That exceeds the existing 3G coverage requisite of 95%. The UK government also proposes to invest £150 million ($240 million) to supplement mobile networks in areas of the country that receive little or no coverage. The final auction will begin in the fourth quarter of 2012.[390]

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[381] www.budde.com Turkey - Telecoms, Mobile, Broadband and Forecasts, October 2011. http://www.budde.com.au/Research/Turkey-Telecoms-Mobile-Broadband-and-Forecasts.html#execsummary (accessed Jan. 19, 2012).

[382] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[383] *Id*.

[384] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[385] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[386] *Id*.

[387] *See* Department for Culture, Media and Sport, *Britain's Superfast Broadband Future*, December 2010, at http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf.

[388] See DCMS: http://www.culture.gov.uk/what_we_do/telecommunications_and_online/7763.aspx (accessed May 22, 2012).

[389] See DCMS: http://www.culture.gov.uk/news/news_stories/8931.aspx (accessed May 22, 2012).

[390] *See* Ofcom: http://media.ofcom.org.uk/2012/01/12/proposals-to-extend-4g-mobile-coverage/ (accessed April 19, 2012).

Market and Competition: BT continued to be the largest UK broadband provider in 2011 with a market share of 29% (1.5 percentage points higher than in 2010). Sky's market share was up by 1.9 percentage points to 16%. Other operators market shares remain relatively the same, with O2/Be at 3.5%, and Virgin Media and the TalkTalk Group at 21.5 and 21%, respectively. Orange and T-Mobile's joint venture, Everything Everywhere's market share was approximately 3.6%.[391]

Wired	**Total**	**Fiber**	**Cable**	**DSL**	**Other**
Fixed broadband subs per 100 inhabitants[392]	32.6	0.5	6.6	25.5	0.0
Fixed broadband subs (December 2011)[393]	20,274,861				
% of households with fixed broadband access (2009)[394]	69.5				
Wireless					
Mobile wireless broadband subs per 100 inhabitants[395]	44.4				
Mobile wireless broadband subs (December 2011)[396]	27,642,015				

[391] The Guardian, *UK Broadband market, July 28, 2011, available at* http://www.guardian.co.uk/business/2011/jul/28/uk-broadband-market-share (accessed May 24, 2012.

[392] OECD Broadband Portal, Table 1d (1) (June 2011) (accessed Dec. 2, 2011).

[393] *Id*.

[394] OECD Broadband Portal, Table 2a (November 2011) (accessed Dec. 16, 2011).

[395] OECD Broadband Portal, Table 1d (2) (June 2011) (accessed Dec. 2, 2011).

[396] *Id*.

Appendix F

Comparing International Broadband Speeds

1. Introduction

Broadband speeds are often measured in three metrics: the advertised speed, the actual speed, and the divergence between the advertised and actual speed. Advertised speeds for a given consumer can generally be obtained either from the ISP serving that consumer or directly from the consumer. The latter approach may create some measurement error. Actual speed is measured primarily by two methods: (i) by installing special hardware on an end user's computer that enables the device to measure actual download and upload speeds and (ii) by running software based tests.[1] For international cities, the most widely used speed data is based primarily on software based tests conducted by Ookla using speedtest.net.[2] This data can be useful in providing an international comparison, but certain caveats should be noted. For instance, since this is a software based test, the physical distance of the end user to the server may be one factor influencing speed measurement. Also, the actual speeds that are observed in each country are a combination of availability and usage. This means that a low average download speed for a country could be a reflection of either more people subscribing to low speed broadband or poor performance and availability of high speed broadband. Despite these shortcomings, the Ookla speed data help in constructing meaningful international comparisons. Additionally, the data provides other metrics of network quality that may be used to evaluate broadband performance across countries.

In this appendix, we analyze broadband speeds in 38 countries using Ookla data on actual speeds, as well as Ookla customer surveys of advertised speeds. Below are some highlights from our analysis:

- The United States ranks 24th (11.6 Mbps) in terms of actual download speeds when these are weighted by the sample size, based on all available data.
- The United States shows a large increase in the average speed with the percentage of tests reporting speeds of 10 Mbps or higher increasing from 30% in 2009 to 80% in 2011 (Figure 1c).
- The shortfall index, or the percentage difference between advertised and actual speed, declined in all countries in 2011 from 2010. In the United States, the shortfall index declined from 7.06% to 6.80% based on self-reported data from consumers (Figure 4), i.e. consumers get 94% of advertised speeds, which is approximately consistent with the findings in *Measuring Broadband America* report.
- The United States ranks 17th (12.5 Mbps) when based on a stratified sampling technique using weighted average actual download speed (Figure 3a).

[1] The former is usually preferred as the speed measurement is not biased by the subscriber's computer configuration, the type of connection between the end user and the ISP's network, and the physical distance of the end user from the testing server. For example, SamKnows conducts such hardware based tests for the U.S. and the U.K. For the U.S., the Federal Communication Commission teamed up with SamKnows to measure the advertised and actual speeds, and the results are summarized in FCC's Report titled "Measuring Broadband America – A Report on Consumer Wireline Broadband Performance in the U.S," available at http://www.fcc.gov/measuring-broadband-america. For information about the U.K. speed testing, *see* http://consumers.ofcom.org.uk/2011/07/consumers-benefit-from-uk-broadband-speed-surge/. However for broad-based international data, software based tests, such as Ookla's speedtest.net, are the best available data source.

[2] This is based on the NetIndex data provided by Ookla.

2. Data Overview

The following analysis is based on the publicly available data provided by Ookla on its Net Index site.[3] This dataset comprises approximately 14.4 million observations of daily broadband speeds and spans over 12,000 cities from 159 countries from 2008 to December 2011.[4] The main difference between the speed data gathered by Ookla and other software based tests is the method by which Ookla measures speed. Most web-based tests measure the average speed of downloading a single file from the internet. Ookla however, adopts a "fill the pipe" approach.[5] This method measures the speed of the broadband connection when multiple computers or programs are using it.[6] Essentially, more data is used to test the faster connections than slower ones, ensuring the speed data reflect the actual speed experienced by the typical consumer.[7]

For this analysis we use the 38 countries selected by the Bureau for the *2011 IBDR*..[8] Section 103(b) of the Broadband Data Improvement Act (BDIA) tasks the Commission with "comparing the extent of broadband service capability (including data transmission speeds and price for broadband service capability) in a total of 75 communities in at least 25 countries abroad for each of the data rate benchmarks for broadband service utilized by the Commission to reflect different speed tiers."[9] As discussed in the report, we interpret "communities" to mean a geographical unit smaller than a nation-state (the sub-national level).[10] Where we have more granular data, as we do for actual speeds, we can examine "communities," namely cities. Therefore, we also present city-level speed comparisons. We

[3] The data extraction was performed on December 15, 2011 from http://netindex.com/source-data/.

[4] There are several daily speed datasets at the country, region and city level that are available from Ookla. Depending on the level of geographic disaggregation, each dataset contains the name of the country where the speed test was conducted, International Organization for Standardization (ISO) country code, region name and code for U.S. States and Canadian Provinces, name of Internet Service Provider, the average download and average upload speed in Kbps, average latency in milliseconds, average latency variation (jitter) in milliseconds, average packet loss in percent, average estimated r-factor, the number of tests analyzed to calculate the index, and the average distance in miles between the client and the server across all tests. We use the daily country and city level data to compare how countries perform on the speed metric.

[5] Frequently Asked Questions, Version 1.02, May 26, 2010, *available at* https://support.speedtest.net/forums/20483933-how-speedtest-net-works and http://www.netindex.com/about/.

[6] This is done by using multiple threads (simultaneous transfers of data) and carefully "right-sizing" the transferred payload." Frequently Asked Questions, Version 1.02, May 26, 2010, pp. 2-3.

[7] *See* Steve Bauer, David Clark, William Lehr, Massachusetts Institute of Technology, "Understanding Broadband Speed Measurements", http://mitas.csail.mit.edu/papers/Bauer_Clark_Lehr_Broadband_Speed_Measurements.pdf ("[T]he Ookla/Speedtest approach – which typically results in higher measured data rates than the other approaches reviewed – was the best of the currently available data sources for assessing the speed of ISP's broadband access service. One of the key differences that accounts for this is that the Ookla/Speedtest tools utilize multiple TCP connections to collect the measurement data which is key to avoiding the receive window limitation. These tests are also much more likely to be conducted to a server that is relatively close to the client running the test.").

[8] Australia, Austria, Belgium, Bulgaria, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea (South), Lithuania, Latvia, Mexico, Netherlands, Norway, Poland, Portugal, Russia, Singapore, Slovakia, Slovenia, Spain, Sweden, Turkey, United Kingdom, United States.

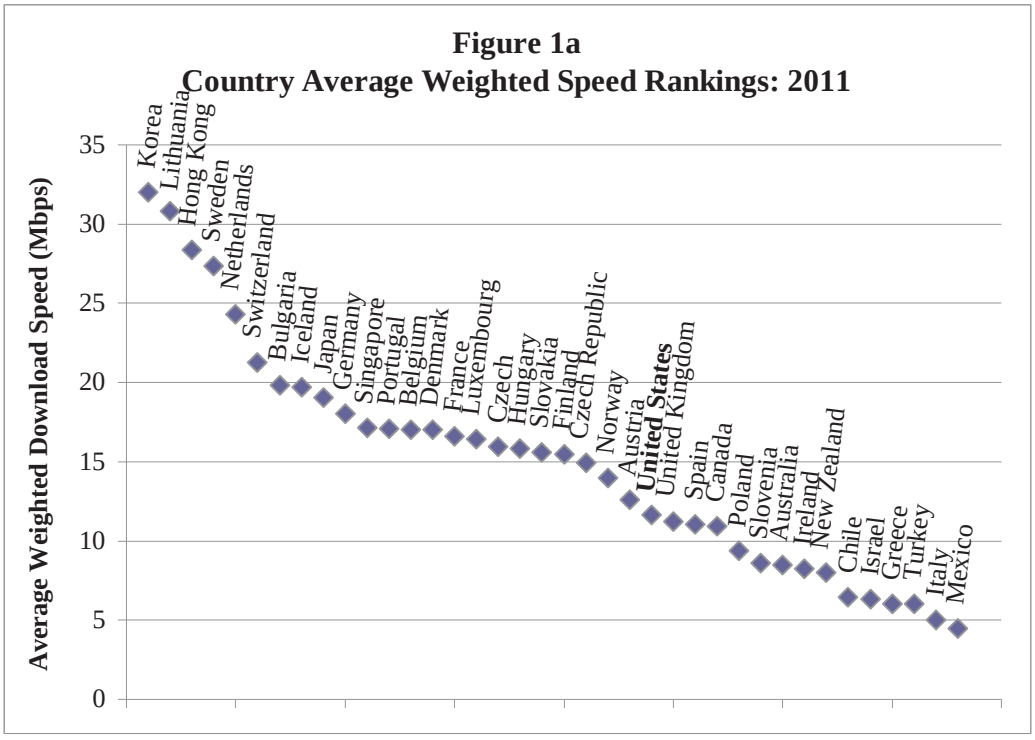
[9] 47 U.S.C. § 1303(b)(3).

[10] *2012 IBDR* at ¶ 34.

start by discussing the rankings on an aggregate, country level based on speed data compiled by the OECD and Ookla, and then analyze the disaggregated data.

3. Aggregate Country Rankings Based on Ookla Data

Figure 1a shows the 2011 rankings based on average download speed (Mbps) for each country chosen in the *IBDR*. These ranking are based on weighted average speed, i.e. the average speed obtained by averaging across cities using the sample size in each city as weights.[11] The U.S. ranks 24th out of the 38 countries in the *IBDR* sample with an average speed of 11.6 Mbps. The speed leaders appear to be the Republic of Korea, Lithuania, Hong Kong, Sweden, and the Netherlands. Mexico, Italy and Turkey are at the bottom of the distribution. The average download speed in 2011 was 32.0 Mbps for Korea, 11.6 Mbps for the U.S., and 4.5 Mbps for Mexico. The data is shown in Appendix F, Table 1a.



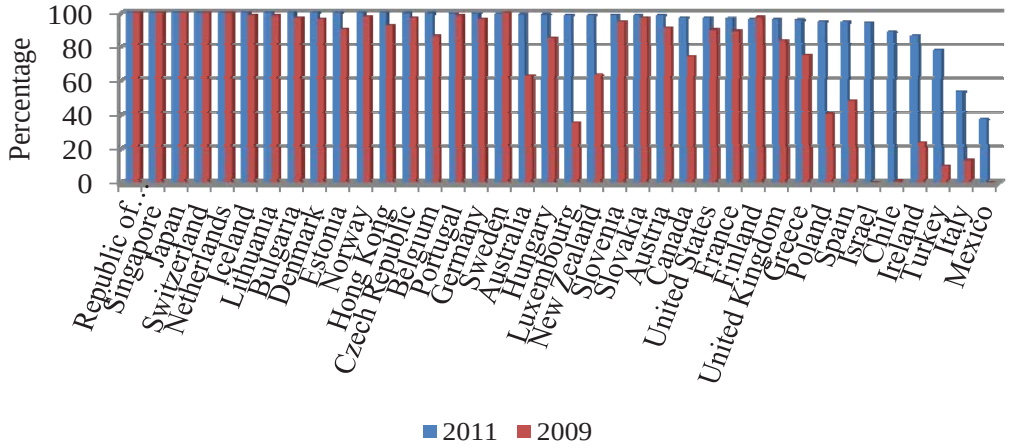
Source: Actual Download Speeds from Net Index by Ookla (Data drawn on Dec. 15, 2011)

The 2011 data presented in Figure 1a is a one-year snapshot, so it fails to provide information on how speeds have changed over the years. It is also more prone to distortions from extreme values as these are raw averages. Therefore, to gain a more nuanced understanding of how speeds have changed over the years, we compare countries in different speed bands for 2009 and 2011, based on the Ookla actual speed data.

[11] We do not use an unweighted average as this does not control for the total number of tests (sample size) used to generate the average actual speed. The ranking based on unweighted average speeds may be biased, since each speed observation gets an equal weight irrespective of how many observations were used to generate it. Ideally, one should weight the average actual speed for a broadband plan by the number of broadband subscribers in that plan in a particular city or country, but that data is unavailable at the international level. The best approximation is to weight the mean city level actual speeds reported by Ookla by the number of tests used to generate the mean.

Figures 1b and 1c, respectively, show the percentage of the tests with actual speeds greater than 5 Mbps and 10 Mbps in 2009 and 2011. By 2011, in about 80% of the countries, including the United States, 90% of the tests show a download speed of 5 Mbps or higher (Figure1b). Some countries, such as Chile, Luxembourg, Poland, Ireland, Israel, Turkey, Italy and Mexico, show dramatic increases between 2009 and 2011. Two countries, Finland and Sweden, report slightly lower average speeds in 2011 than 2009.[12]

Figure 1b
Percentage of Tests Reporting Greater than 5Mbps of Download Speed, 2009 and 2011

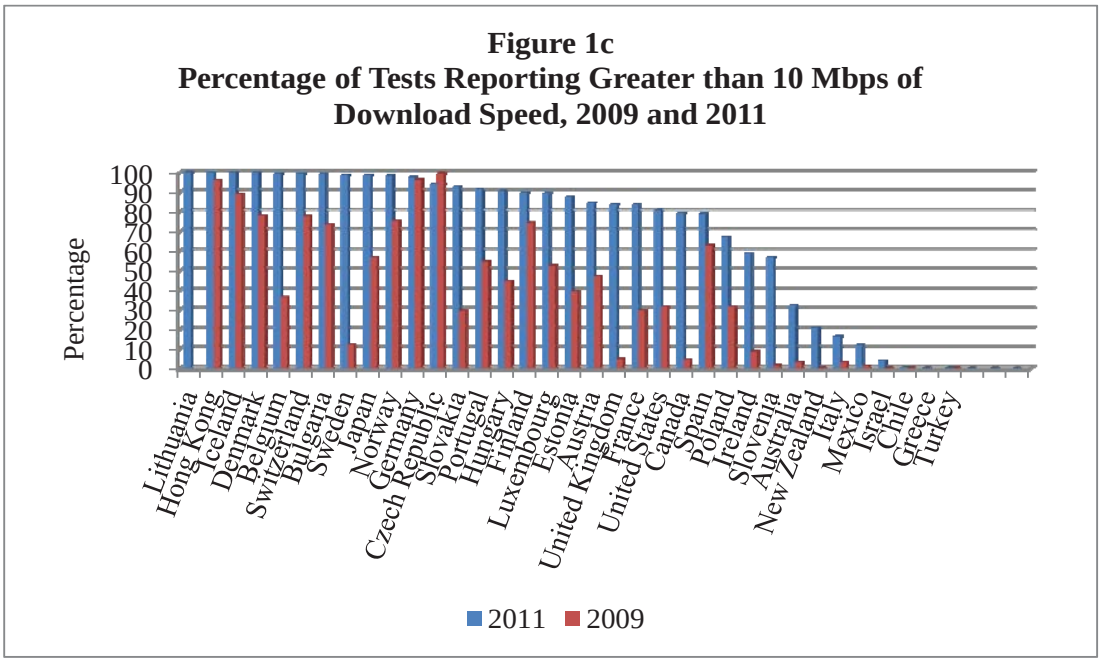


Source: Actual Download Speeds from Net Index by Ookla (Data drawn on Dec. 15, 2011)

In approximately 37% of the countries, 90% of the tests show an average speed of 10 Mbps or higher by 2011 (Figure 1c). Countries such as Belgium, Slovakia, Norway, Estonia, France and Austria experienced an increase from less than 40% in 2009, to 75-100% at 10 Mbps or higher download speeds in 2011. Canada and U.K. have seen an increase from 5% to 80%. Spain, Poland, Ireland and Slovenia show dramatic increases in average speed as well. Likewise, the U.S. shows a large increase – the percentage of tests reporting speeds greater than 10 Mbps increased from 30% in 2009 to 80% in 2011.

[12] This could be a result of greater uptake in the low speed band offerings in 2011, thus dampening the average speed, the result of a selection bias, or could be interpreted as a lowering of quality. A selection bias would occur if lower speed customers took the test in greater numbers in 2011 than in 2009.

Figure 1c
Percentage of Tests Reporting Greater than 10 Mbps of Download Speed, 2009 and 2011



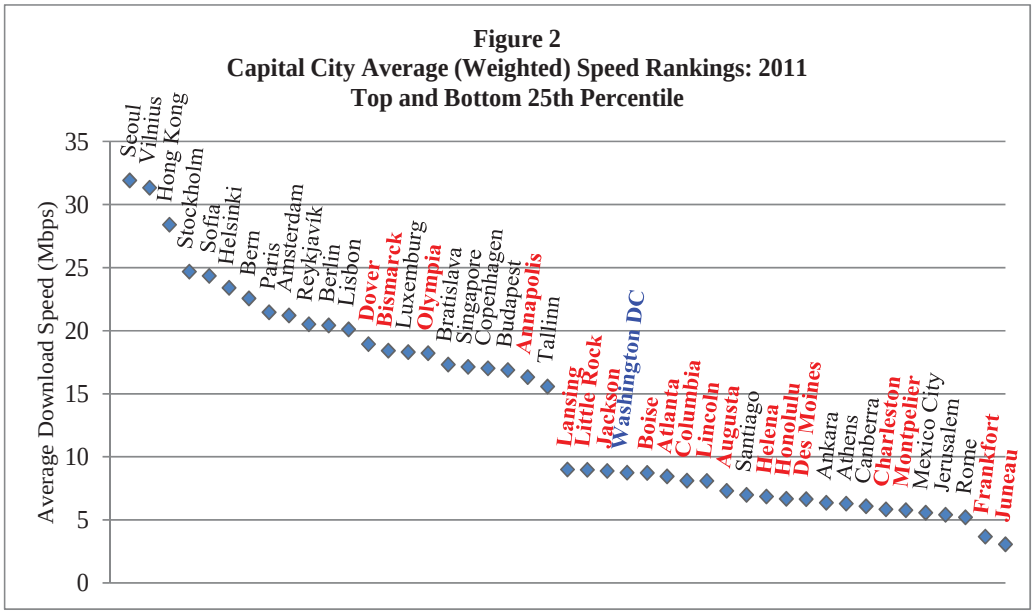
Source: Actual Download Speeds from Net Index by Ookla (Data drawn on Dec.15, 2011)

4. Speed Comparisons at the City Level

Aggregate country rankings based on averages fail to take into account differences in demand and cost conditions across cities within a country. Moreover, the number of cities in which the speed tests are conducted, and the characteristics of those cities, differ by country, skewing the aggregate results further. To partially solve this problem, we compare speeds at the city level.

In the following analysis, we first compare the broadband speeds (weighted by sample size) of the capital cities in the 38 countries, including Washington, D.C., and all of the U.S. state capitals (88 cities in aggregate), based on 2011 data. Figure 2 shows the ranking of capital cities for the top 25th and bottom 25th percentile of the mean download speed distribution (weighted by the sample size). This is done for ease of exposition, and a detailed table is provided in Appendix F, Table 2a. Seoul (Korea) is ranked in first place, followed by Vilnius (Lithuania), Hong Kong,[13] Stockholm (Sweden), Sofia (Bulgaria). Several U.S. state capitals compare favorably with their international counterparts. Dover (Delaware) reports the highest average speed during this period and ranks 13th out of 88 capital cities, with Bismarck at 14th, Olympia at 16th, and Annapolis at 21st. However, several other U.S. cities are in the bottom quarter of the distribution with Juneau (Alaska) having the lowest rank.

[13] We use the weighted average of the whole country as the speed data are not disaggregated by regions in Hong Kong.



Source: Actual Download Speeds from Net Index by Ookla, weighted by the sample size (Data drawn on Dec. 15, 2011)

Capital cities covering large metro areas are more diverse economically than smaller capitals, and therefore may report lower average speeds. Additionally, the demographic composition of U.S. state capitals is a large number of low-income residents, with wealthier citizens concentrated in the suburbs. The scenario is the reverse for most international capital cities. This difference implies that U.S. capitals will typically report lower broadband speeds due to price-sensitivity. This may be a significant reason why U.S. state capitals report lower speeds when compared to international capitals. In addition, as mentioned earlier, software-based speed measures are often impacted by the distance between the customer and the server. To partially address these issues, we restricted the sample to cities within 100 miles of a server, and then used a random sampling technique to select the two cities from this subset. This controls for a significant factor that can cause differences in speed, and makes the cities more comparable.[14] Results are presented in Appendix F Table 2b and 2c.

5. Speed Comparisons Using a Stratified Sampling Technique

The aggregate country rankings presented in Figure 1 would be a sufficient basis for international comparison if the Ookla data set had speed data for all cities for the 38 countries in our sample. However, given that it does not have data for every city in each of these countries, the aggregate rank may be biased. A stratified sampling would choose an optimal number of cities from each population strata to reflect the actual dispersion of cities in a country. For example, suppose a country has 90 small cities (say low average speed) and 10 large cities (say high average speed). But Ookla may have data for only 10 large cities and 25 small cities. In that case the aggregate rank will show a higher speed that we would actually get if we had the data for all cities. The stratified sampling would involve choosing 90% from the small city sample and 10% from the large city sample to come with an aggregate ranking. A stratified sampling approach divides the sample of cities into different non-overlapping bins according to their

[14] We did not do a simple random sampling procedure as this method may yield cities that differ significantly, comparisons may be flawed. We restricted the sample to cities within 100 miles of a server, and then used a random sampling technique to select the two cities from this subset. This controls for a significant factor that can cause differences in speed, and makes the cities more comparable.

population level, and then draws a sample from each bin. If large cities have inherently different broadband characteristics from smaller and sparsely populated cities, then a stratified sample will achieve greater precision than an aggregate ranking. Additionally, analyzing each stratum separately can give valuable insights about how demography can drive broadband characteristics. We implement this methodology on a country by country basis for non-U.S. countries and on a state by state basis for the United States.

There are two main steps when implementing a stratified sampling approach: (a) choosing the overall optimum sample size and (b) choosing the sample size in each strata. Choosing the overall optimal sample size[15] requires three inputs; the estimated variance in the population, the confidence interval, and the confidence level. In this case, the estimated variance (σ^2) is the calculated variance in speed obtained from the measured speed data. Large estimated variances increase the optimal sample size and vice versa. The confidence interval (δ) reflects the level of precision with which the sample predicts the true values, *i.e.* it is a measure of the sampling error and is often referred to as the margin of error. It is fairly standard to choose between ±1% and ±5% confidence interval. We choose a ±2% confidence interval to be conservative. This implies that the true population mean speeds will lie within ±2% of the estimated sample mean. The confidence level shows the risk a researcher is willing to accept that the sample is within the average of the population. We choose a 95% confidence level which is standard in the literature. These levels correspond to percentages of the area of the normal density curve. A 95% confidence interval covers 95% of the area under the normal bell curve, or alternatively, the probability of observing a value outside of this area is less than 5%. This implies if the speed data was sampled 100 times, 95 of these samples would have the true (population) mean speed within the margin of error specified earlier. When calculating the optimal sample size, we will use the z-value[16] (1.96) that corresponds to the 95% confidence level for the normal density curve. Thus the optimal sample size (n) is given by:

$$n = \frac{z^2 \sigma^2}{\delta^2}$$

We use the above formula to calculate the optimal sample size for the United States and non-U.S. countries separately. As explained above, we use the following values, z=1.96 and δ=2. We estimate the variance of speed (σ^2) from the monthly Ookla city-level speed data for each country, and the results are presented in Appendix F, Table 4a. The optimal sample for each country is in Appendix F, Table 4b.

Next we use population levels[17] to determine the appropriate strata and the proportional allocation rule to choose the optimal sample size (number of cities) in each stratum. This rule specifies that the proportion of cities in each sample stratum must mirror the proportion of cities in the population strata. Strata sample sizes are determined by the specification given below:

$$n_s = \frac{N_s}{N} * n$$

Where: *ns* is the sample size in each stratum, *Ns* is the total number of cities in each stratum, *N* is the total number of cities in each country, and *n* is the total (optimal) sample size.

[15] *See* Bartlett, Kotrlik and Higgins; "Organizational Research: Determining Appropriate Sample Size in Survey Research," Information Technology, Learning, and Performance Journal, 19(1), Spring 2001.

[16] The z-value for 95% confidence level specifies the point on the standard normal density function where the probability of observing a value greater than z (1.96) is equal to 0.025 or the probability of observing a value less than z (1.96) is equal to 0.975.

[17] Ideally we would use the population density data to create the strata, but data availability issues prevent us from using this variable.

For example, if 20% of the U.S. population lives in cities of 20,000 inhabitants or less and our optimal sample size for the U.S. is 50, then 10 out of the 50 cities in the final stratified sample should have less than 20,000 inhabitants. To implement this, we collect the latest available population data on over 12,000 major cities[18] in the 37 non-U.S. countries included in the 2012 *IBDR*. For the United States, we collect data for over 2500 cities from the 2010 U.S. census.[19] We show the population proportion in each strata for the U.S. and non-U.S. cities[20] in Appendix F, Tables 3a and b.

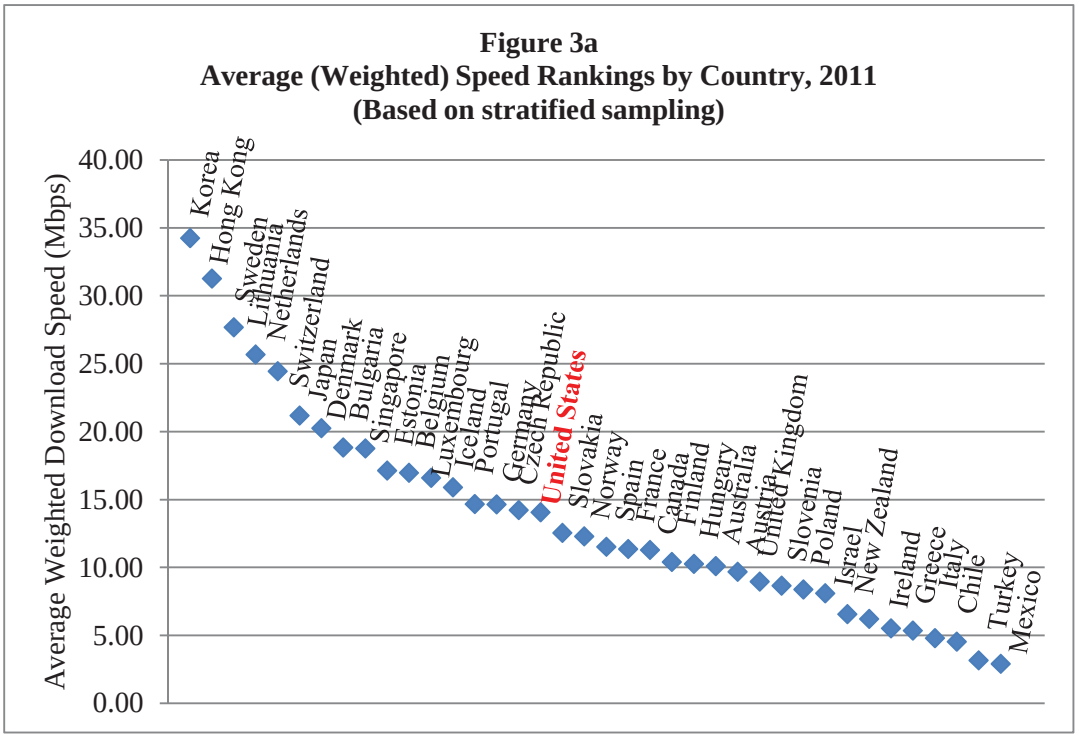
Using the number of cities covered in the Ookla data, and the associated variance in download speed in those cities in 2011, we first determine the optimal sample of cities that we need. Next, we construct 4 population strata for cities. Very small cities have less than 25,000 inhabitants, small cities have greater than 25,000 and less than 50,000 inhabitants, medium cities have greater than 50,000 and less than 100,000 inhabitants, and large cities have greater than 100,000 inhabitants. Based on this, we determine the proportion of cities that falls under each stratum, in each country or U.S. state. These proportions combined with the optimal number of cities that need to be covered in each country determine the final stratified sample. Using the stratified sample we construct country speed ranks. Figure 3a shows this country ranking.[21] We find these are consistent with our earlier results with Korea, Hong Kong and Sweden in the leading ranks, and United States ranked 18th out of 38 countries (12.5 Mbps). The data is presented in Appendix F Table 3c.

[18] For most countries the latest available population data is from 2010 and 2011. The exceptions are: Australia (2006), Canada (2006), Chile (2002), France (2009), Ireland (2006), Republic of Korea (2009), Portugal (2008), UK (2008).The data is collected from "*Thomas Brinkhoff: City Population, http://www.citypopulation.de*". We collect data on over 6400 major cities from this website. The definition of major cities varies by country. For most countries it is cities with a population of 20,000 or more. For Iceland it is cities with greater than 500 inhabitants and Estonia has no lower limit. For New Zealand, it includes cities with population greater than 2500 inhabitants, for Luxembourg it is 3000, and for Ireland it is 3500. For Denmark, Lithuania and Slovenia it covers cities with greater than 5000 inhabitants. For Portugal it is 7500 inhabitants. For Australia, Canada, Norway and Sweden it is cities with greater than 10,000 inhabitants. For Germany, it is 15,000 inhabitant or more. For UK and Italy major cities are those with populations greater than 50,000 inhabitants. Additionally, there is another 5500 smaller cities and towns in the Ookla data set that are not present is the major city population data. We assume that the population of these smaller Ookla cities is lower than the minimum population cutoff reported in the population data.

[19] *US Census: http://quickfacts.census.gov/qfd/index.html*

[20] These are aggregate percentages for non-U.S. cities. However, the stratified sampling is done at the country level, and thus the proportions in each strata vary by country.

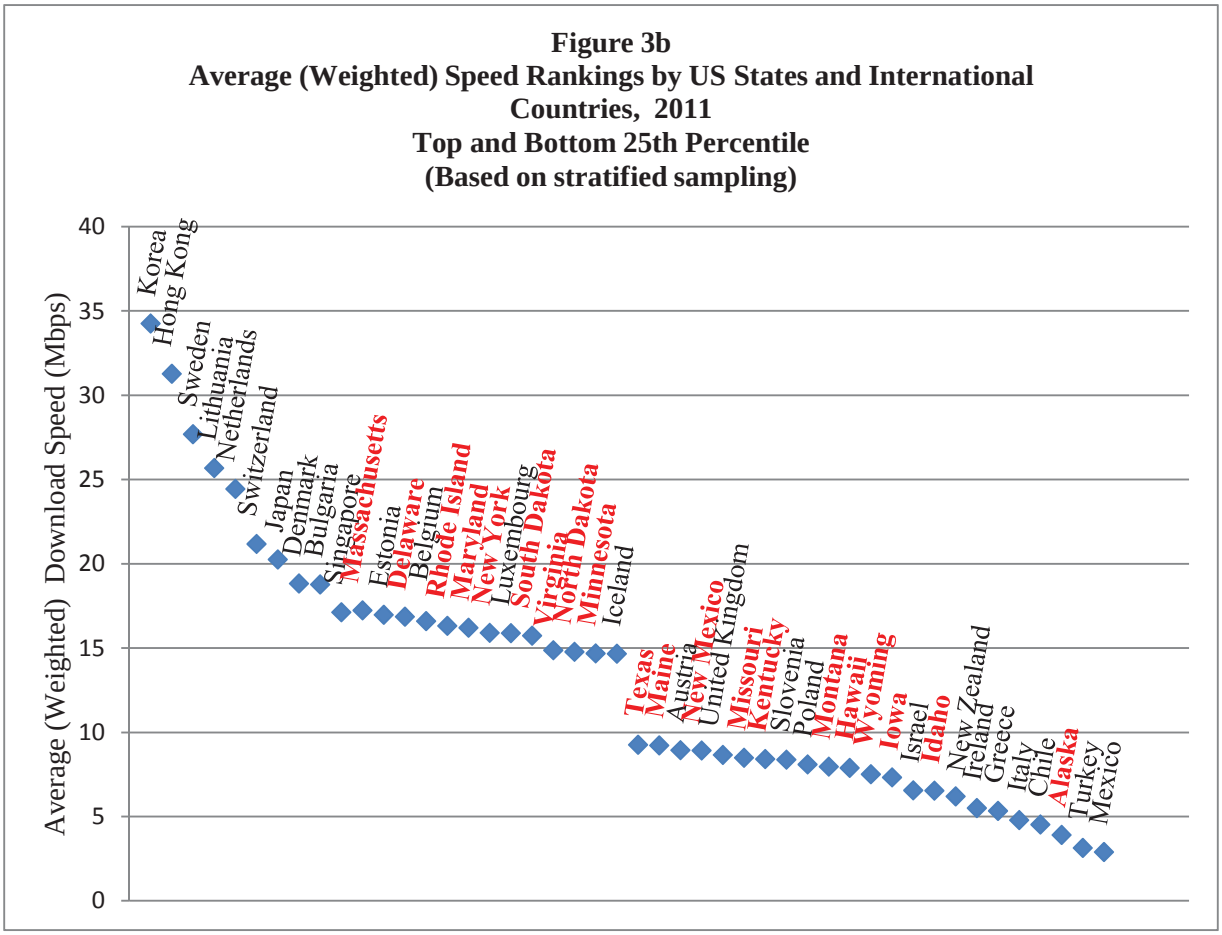
[21] These rankings are based on average weighted download speeds.



Source: Based on Actual Download Speeds from Net Index by Ookla, weighted by the sample size (Data drawn on Dec. 15, 2011)

Figure 3a, however, masks the considerable variation that exists amongst U.S. states. Comparing aggregate United States averages with those of other countries may be less meaningful than a more disaggregated approach that takes such variation into account. Therefore, we now implement a disaggregated stratified sampling approach for the U.S., where each state is the basis of the sample. Figure 3b, shows the speed rankings for the top and bottom 25% of the combined non-U.S. country and United States state data based on this approach. We find that Massachusetts is ranked 11th, Delaware 13th and the 15th, 16th and 17th place are taken by Rhode Island, Maryland, and New York. The data is presented in Appendix F Table 3c.

Figure 3b
Average (Weighted) Speed Rankings by US States and International Countries, 2011
Top and Bottom 25th Percentile
(Based on stratified sampling)



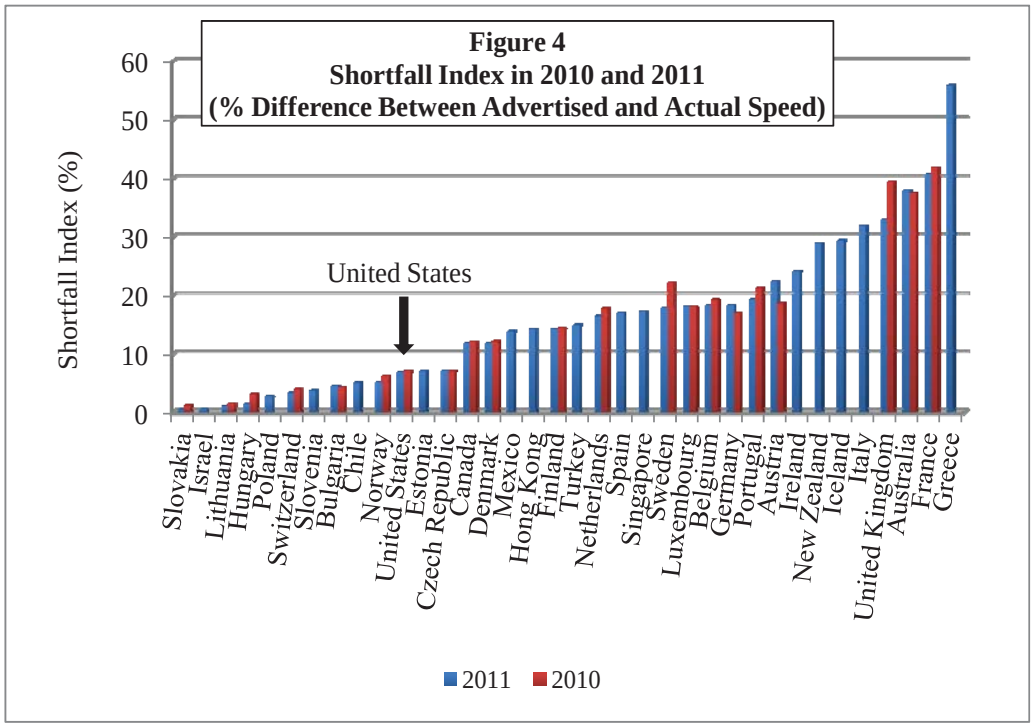
Source: Based on Actual Download Speeds from Net Index by Ookla, weighted by the sample size (Data drawn on Dec. 15, 2011)

In addition to analyzing the overall speed ranks based on the stratified sampling approach, we can also show how each country ranks within each stratum. Appendix F Tables 4a-4d present these results. We find that Korea and Hong Kong command the top ranks in all population stratum in which they are present.[22] The aggregate rank for Massachusetts (Figure 3b) is driven by the speed performance in less populated cities, i.e. the cities in stratum 1 and 2, where the average download speed is around 18.5 Mbps. In the large city stratum (Appendix Table 4d), Massachusetts is in the lowest 25th percentile, with an average speed of 10 Mbps. Delaware, which is ranked 13th in the aggregate (Figure 3b) shows a similar pattern. Assimilating the information about the significant variation amongst U.S. states, and in different population strata, may lead to a more nuanced understanding about the performance of broadband in the United States.

6. Advertised versus Actual Speed

[22] All countries/states may not be in this data if there are no cities in that particular population stratum for that particular country/state in 2011.

To investigate how actual speed data compares with the advertised speeds, we construct a shortfall index (Appendix Table 5) based on the Ookla promise index data.[23] The data on advertised speed is collected by Ookla from a survey of the consumers who take the speed test. Thus, apart from the bias due to self-reporting, this method ties the advertised speeds to actual plans, and avoids the problem of picking up plans that may not have many subscribers, a criticism often targeted at web harvest data. The shortfall index shows the percentage difference between advertised and actual speed. From Figure 4, three things are obvious. First, the advertised download speeds in all countries are overstated. Second, there is a wide variance in the shortfall index and some countries, such as Greece, have large differences between the advertised and actual speed. Third, the shortfall index is lower for all countries in 2011 when compared to 2010. Therefore, indices that rank countries based on advertised speeds will overstate the rank for countries with a high shortfall index compared to countries with a low shortfall index.



Source: Promise Index from Net Index Data by Ookla (Data drawn on Dec. 15, 2011)

OECD versus Ookla Data: Country Speed Comparisons

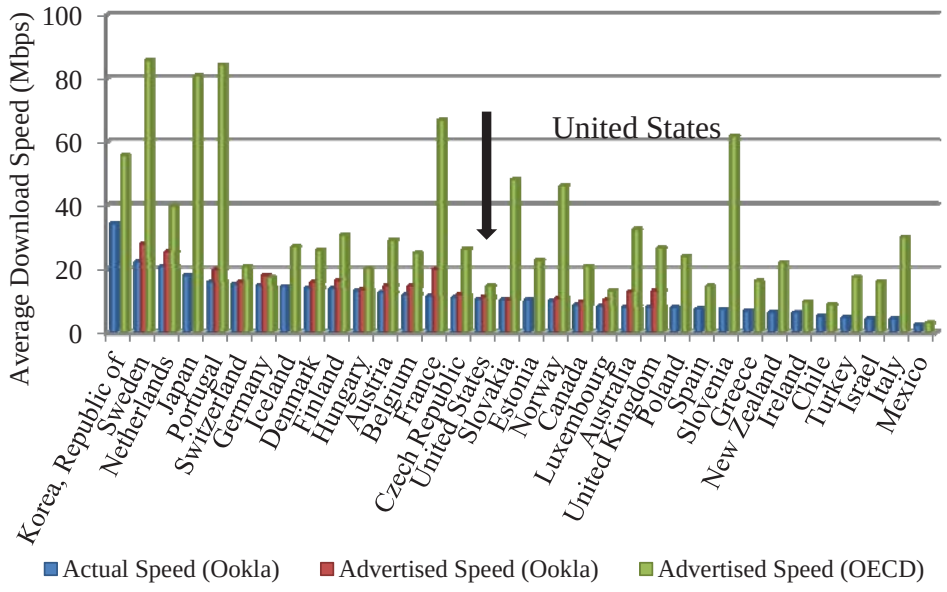
i. September 2010 Data

The OECD publishes data on advertised speeds by country. The data is constructed from surveys of broadband plans that are offered in each country, and the plans are chosen based on a market baskets approach. The Ookla data, as explained earlier, is obtained from actual speed tests by consumers. The advertised speeds in Ookla are obtained from surveying consumers who take the speed test. The

[23] The promise index is the median ratio of actual download speed to the advertised download speed subscribed to by the consumer. The shortfall index is: 1 – (Actual Speed/ Advertised Speed).

OECD September 2010 data[24] show that the U.S. is 29th out of 34 countries with an average advertised download speed[25] of 14.6 Mbps. For the same month, the Ookla data shows an average actual download speed of 11.3 Mbps for the United States and has it ranked 18th out of 34 OECD countries. The rankings based on the advertised speeds obtained from Ookla are not much different than the rankings based on their average speed reports.[26] Figure 5, shows the advertised and actual speeds for 2010.

Figure 5
Actual versus Advertised Speed, September 2010



Source: Net Index data (Actual Download Speed, Promise Index) from Ookla and OECD data from the OECD Broadband Portal (Table 5a)[27]

ii. September 2011 Data

The September 2011 data shows that when OECD (average) speeds are compared, the U.S. is ranked 18th out of 34 countries[28] with an average advertised download speed[29] of 29.4 Mbps.[30] If we adjust

[24] This data was originally in http://www.oecd.org/sti/ict/broadband, Table 5a. However, this has since been updated with the 2011 data and is no longer available on the OECD website.

[25] The OECD data source notes that "The offers used to calculate the average speed include all combinations of single, double and triple-play offers in the survey. This is because some top-speed broadband subscriptions only are available as part of a package."

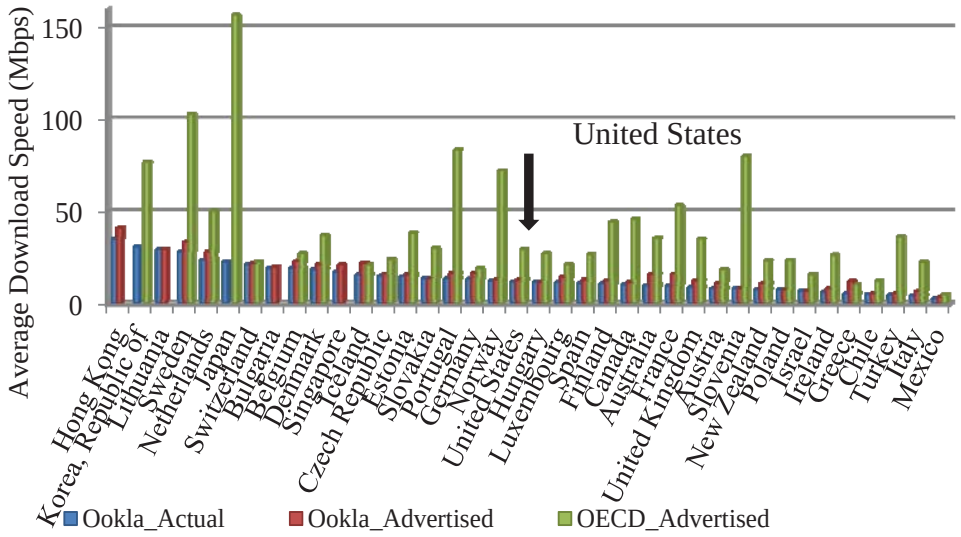
[26] The U.S. average advertised speed from Ookla is 12.2 Mbps for September 2010.

[27] The data was available at http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html. It is no longer available and has been updated to 2011 data.

[28] The rank would be 22nd if the countries in the *IBDR* were added to the list.

the OECD advertised speeds with the shortfall index (Appendix Table 5), then the U.S. rank is 16th.[31] When ranked by mean actual speed (11.9 Mbps in September 2011), the U.S. ranks 15th out of 34 OECD countries based on the Ookla data. The *IBDR* includes four countries not in the OECD (Bulgaria, Hong Kong, Lithuania, and Singapore). If the ranking is based on the *IBDR* countries, then United States ranks 19th out of 37 countries. In the OECD data there is a large dispersion between the mean and median advertised speed for the United States: the mean is twice the median. Figure 6 shows the actual and advertised speeds obtained from Ookla,[32] and the advertised speeds from the OECD data for 2011.

Figure 6
Actual versus Advertised Speed, September 2011



Source: Net Index data (Actual Download Speed, Promise Index) from Ookla and OECD data from the OECD Broadband Portal (Table 5a).[33]

As is apparent in Figure 5 and 6 (Appendix F Table 6), both the actual and advertised speeds reported by Ookla are substantially lower than the OECD advertised speeds for all countries.[34] One likely

[29] The OECD data source notes that "The offers used to calculate the average speed include all combinations of single, double and triple-play offers in the survey. This is because some top-speed broadband subscriptions only are available as part of a package."

[30] When the median advertised download speeds are compared however, the U.S. rank is 19th, with the U.S. median speed being 15.7 Mbps. Thus the average speed appears to be influenced a few high speed offers. The median ranking may be a better comparison as it is unaffected by extreme values.

[31] Japan and Korea are missing from the Promise Index data from Ookla.

[32] The Net Index dataset publishes the Promise Index, which is a ratio between the median actual and advertised speeds. We have used this ratio to obtain the Ookla mean advertised speed based on the reported actual download speed. We calculate: Advertised Download Speed = Actual Download Speed/ median_download_ratio. Note that the median download ratio is based on the response of users who actually filled the survey after taking the speed test online, and is a much smaller subset of the number of people actually taking the speed test (between 0.2 and 3%). Additionally, this data is available only for 36 of the 38 *IBDR* countries for September 2011 (Japan and Korea are missing).

[33] http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html

explanation is that the OECD survey is based on advertised speeds for all plans offered by broadband companies in a country, irrespective of uptake, while the Ookla data reports advertised speeds only for plans that consumers have. For example, companies may offer a 100 Mbps plan, which few customers may actually buy. The OECD data weights the 100 Mbps speed equally with other plans, whereas the Ookla data does not.[35] In addition, the OECD advertised speed is based on surveys administered by the OECD, while the Ookla data is based on self-reporting by users who take the speed test. One could argue that users do not often have good information about the advertised speed that their carrier had promised and may be filling in a number close to actual speed displayed when they take the test.

We also note that there are large differences in the average speed data from September 2010 and 2011. For example, in the OECD data, the United States average speed doubled in just one year. The average speed for Japan is approximately 156 Mbps in 2011 as compared to 80 Mbps in 2010. For France, the average speed declined to 53 Mbps in 2011 from 67 Mbps in 2010. The differences in these speed ranks based on the OECD and Ookla data warrant a deeper analysis of data collection techniques and their comparability.

7. Other Quality Measures

The focus of our discussion so far has centered on the speed of broadband connection, which measures the average rate at which information packets travel from a source to a destination. There are, however, other metrics of network quality that may provide insight about comparative broadband performance across countries. The data provided by Ookla for these performance measures are for some selected international cities only. The coverage is substantially lower than that of the speed data. In the speed data, there were approximately 7000 non-U.S. cities and over 4700 United States cities covered by Ookla. For the other quality metrics, the data covers 398 non-U.S. cities and 305 United States cities. All metrics are based on the average of all cities within each country, weighted by the number of total tests that generated the city average. We discuss three such metrics: latency, jitter, and packet loss. The data is presented in Appendix C Tables 7a-9b.

i. Latency

Latency refers to several types of delays typically incurred during network data processing, and is typically measured in milliseconds (ms). One common measure is round-trip latency, which measures the amount of time it takes a data packet to travel from a source to a destination and back. More precisely, it is measured as the sum of time from the start of packet transmission by a source to the start of packet reception by a destination plus the time that it takes for the packet to travel back from the receiving destination to the source.[36] Latency is often affected by factors such as the properties of the physical medium through which the network packets are transmitted or processing delays which may occur when the packets need to pass through proxy servers.

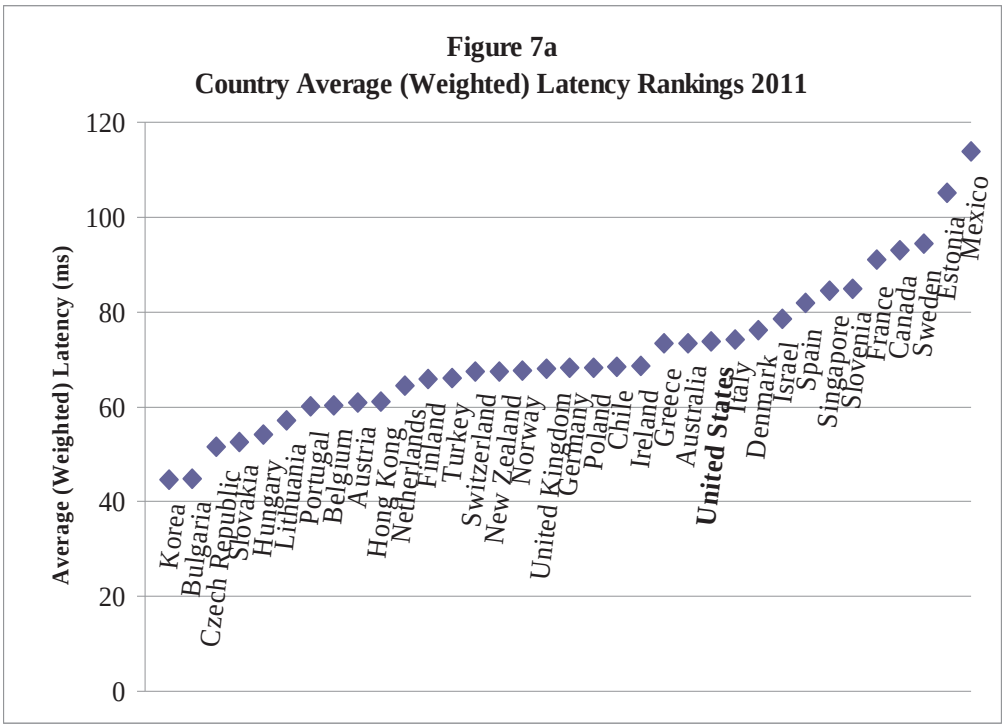
In Figure 7a, we plot the average (weighted) latency for the *IBDR* sample countries. Korea has the lowest latency and Mexico has the highest. The U.S. ranks 24th when ranked in terms on average

[34] One caveat when comparing the rankings based on these data is that the two come from different sources. The actual speed data is from Ookla is obtained from people who take the speed test online. The OECD data is based on a limited number of offers and the associated advertised speeds.

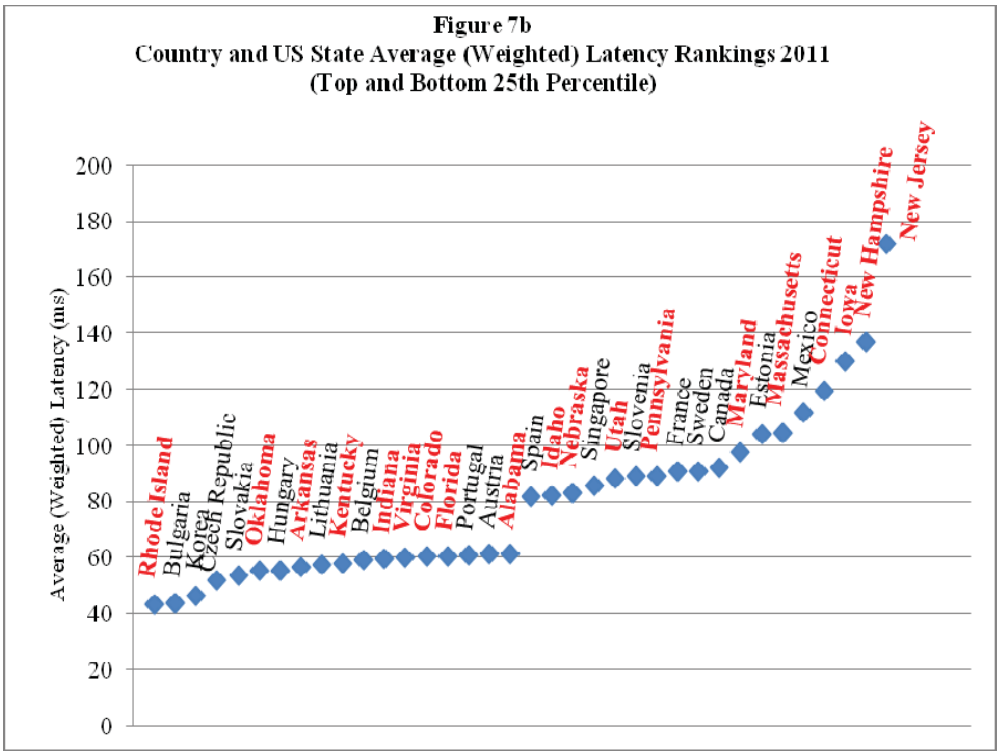
[35] Another explanation could be the method we used to obtain the advertised speed from the Ookla data. If the relation between the mean advertised and mean actual speeds is different from that of the median, it may create this difference.

[36] This excludes the amount of time that a destination system spends processing the packet.

weighted latency. This ranking however, masks the substantial differences that exist within the U.S. Therefore in Figure 7b, we plot the U.S. states.[37] We find that Rhode Island has the lowest latency, followed by Bulgaria, Korea and the Czech Republic. New Jersey has the highest latency, with New Hampshire, Iowa and Connecticut at the top of the distribution. We find that there is wide variation within the U.S, with about half of the states in both the upper and lower 25th percentile.

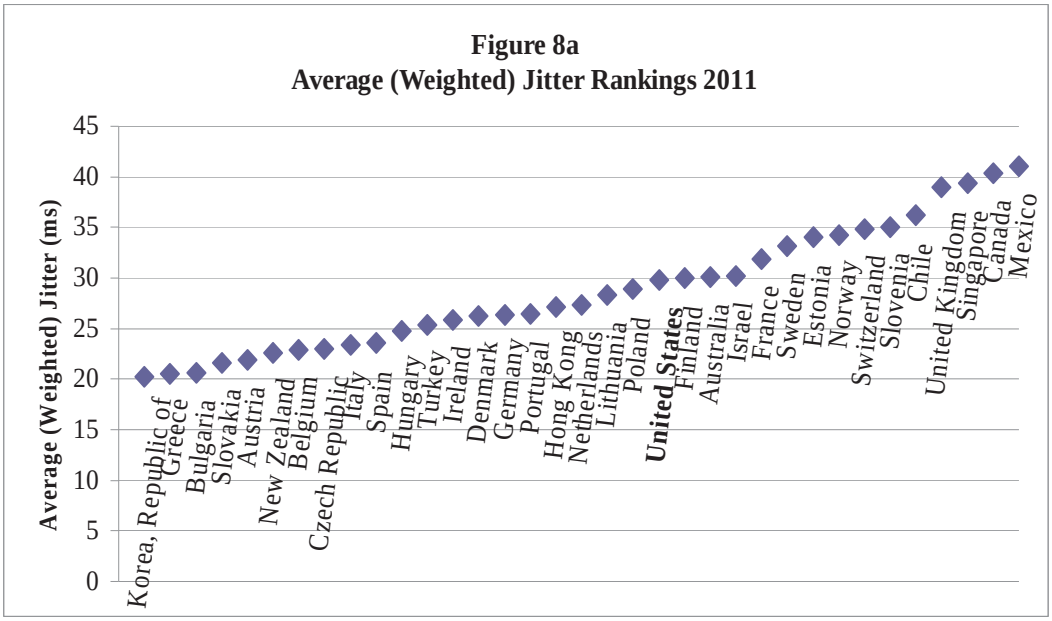


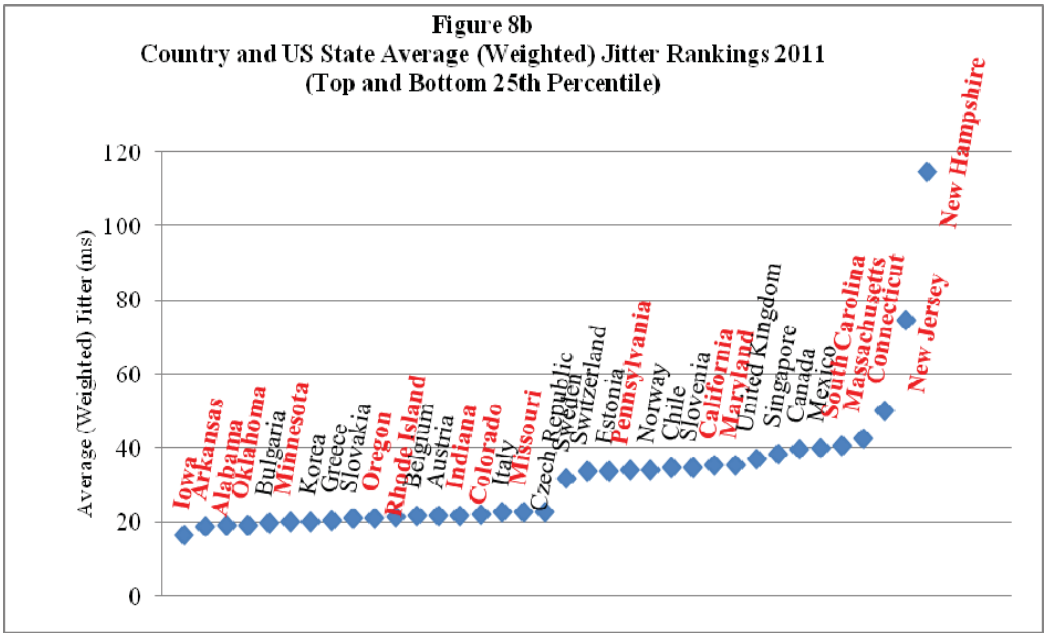
[37] The latency, jitter, and packet loss data is available for only 38 states. The states not included are: Delaware, Hawaii, Louisiana, Maine, Mississippi, Montana, New Mexico, North Dakota, South Dakota, Vermont, West Virginia, and Wyoming.



ii. Jitter

Jitter refers to the variance of latency over time, and is measured by the average deviation from the mean latency of the network. In Figure 8a, we plot the average (weighted) jitter for *IBDR* countries. The U.S. is again in the middle of the rankings. Korea has the lowest and Mexico has the highest jitter. It appears that countries that perform well in speed metrics also have low latency and low jitter. In Figure 8b, we disaggregate the data by U.S. states. We find that Iowa has the lowest jitter, followed by Arkansas, Alabama and Oklahoma. New Hampshire, New Jersey and Connecticut once again are at the very top of the distribution, with high jitter numbers. Massachusetts is in the upper 25th percentile for jitter, but it was ranked 8th in average speed. We also find that although Iowa has high latency (Figure 7a), it has low jitter (Figure 7b).





iii. Packet Loss

When packets of data travelling across the network fail to reach their destination, the phenomenon is termed packet loss. Packet loss can occur because of network congestion, signal degradation, faulty network drivers or networking hardware, and the distance between the origin of the transmitted data and the destination. When packet loss occurs due to these reasons, it can be used as a quality loss metric. In some cases, however, packet loss may be intentional, and intended to slow down specific services. Therefore, packet loss statistics, while still useful in measuring connection reliability, is more nuanced.

In Figure 9a, we plot the average (weighted) packet loss for the *IBDR* countries. Israel leads all other countries and has the lowest packet loss. Greece performs the worst in this metric. The U.S. is in the middle. To understand the variations within the U.S., we look at the states in Figure 9b. In Figure 9b, we plot the average (weighted) packet loss for the top and bottom 25th percentile of countries/states. We find that given our sample, Connecticut has the lowest packet loss, followed by Israel, New Jersey, Estonia and Korea. New Jersey and Connecticut, which had performed poorly in terms of latency and jitter, now perform well. Finland, Greece and Alabama are at the top of the distribution, with very high average packet loss. Depending on which characteristics were valued by consumers, the relative performance of the countries and states would be evaluated differently.

Figure 9a
Country Average (Weighted) Packet Loss Rankings 2011

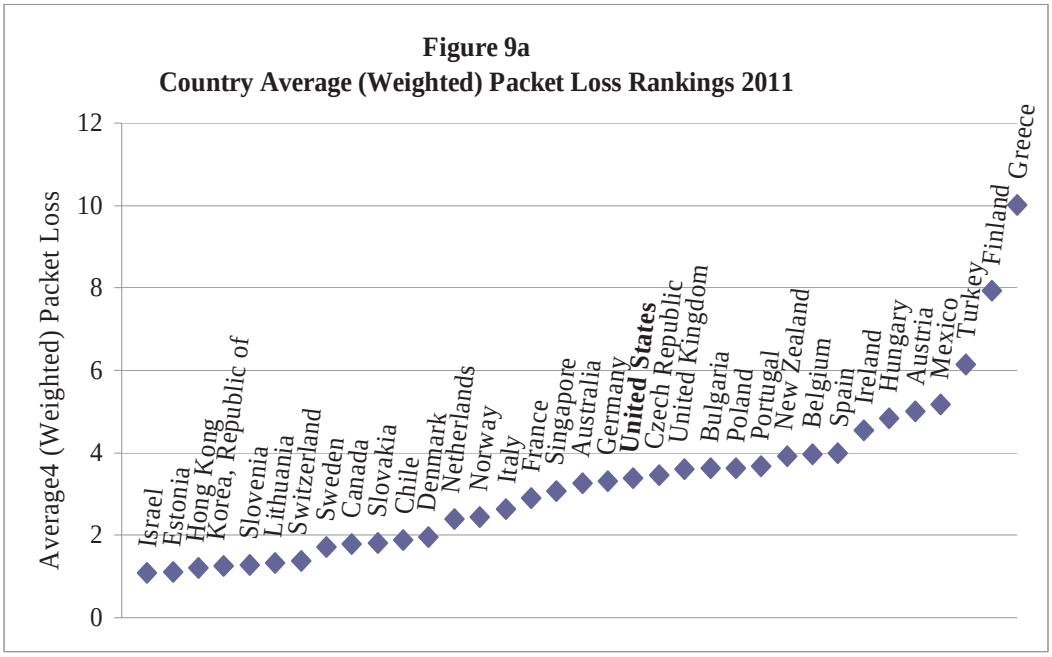
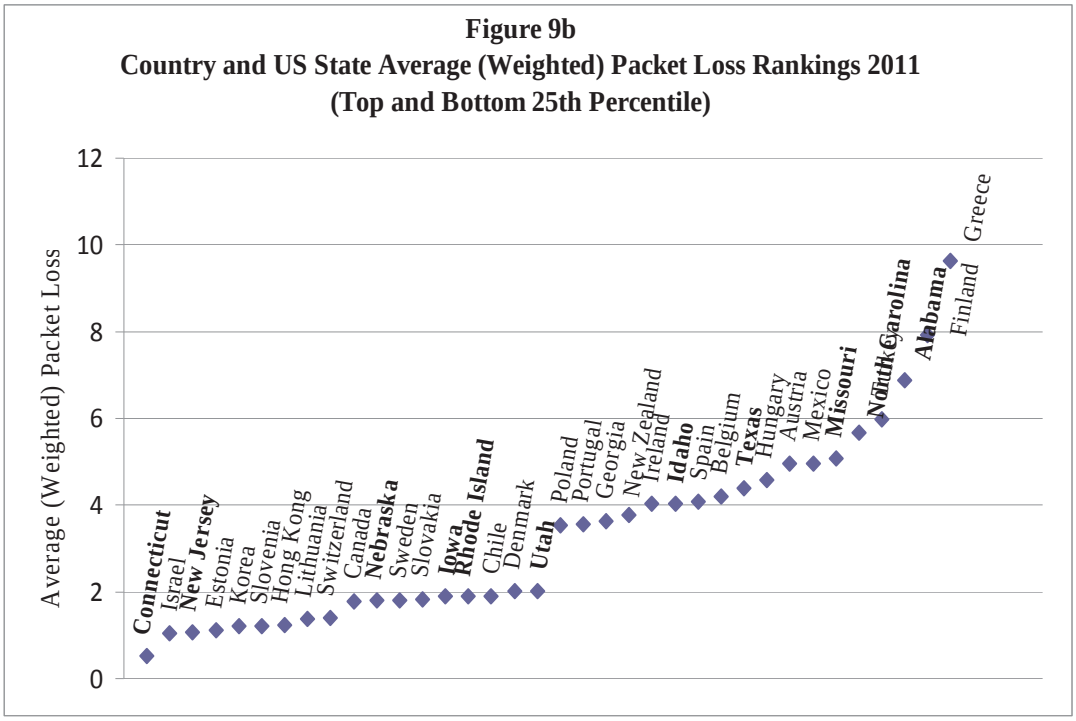


Figure 9b
Country and US State Average (Weighted) Packet Loss Rankings 2011
(Top and Bottom 25th Percentile)



Appendix Table 1
Average (Weighted) Actual Download Speeds (2011): All Available Data

Country	Download Speed (Mbps)	Rank	Country	Download Speed (Mbps)	Rank
Korea	32.01	1	Finland	15.49	20
Lithuania	30.81	2	Czech Republic	14.91	21
Hong Kong	28.39	3	Norway	14.00	22
Sweden	27.37	4	Austria	12.59	23
Netherlands	24.31	5	United States	11.64	24
Switzerland	21.24	6	United Kingdom	11.24	25
Bulgaria	19.85	7	Spain	11.05	26
Iceland	19.68	8	Canada	10.94	27
Japan	19.08	9	Poland	9.39	28
Germany	18.05	10	Slovenia	8.63	29
Singapore	17.12	11	Australia	8.46	30
Portugal	17.06	12	Ireland	8.27	31
Belgium	17.02	13	New Zealand	8.02	32
Denmark	17.01	14	Chile	6.46	33
France	16.60	15	Israel	6.32	34
Luxembourg	16.42	16	Greece	6.06	35
Estonia	15.97	17	Turkey	6.03	36
Hungary	15.83	18	Italy	5.03	37
Slovakia	15.60	19	Mexico	4.46	38

Note: Actual (average) weighted download speed data computed from the city level daily data from Ookla. The average weighted speed was obtained by averaging across cities using the sample size in each city as weights.

Appendix Table 2a
Average (Weighted) Download Speeds (2011): Non-US Capital Cities & US State Capitals and Washington D.C.

Country	City	Average (Weighted) Download Speed (Mbps)	Rank
Korea, Republic of	Seoul	31.9	1
Lithuania	Vilnius	31.3	2
Hong Kong	Hong Kong	28.4	3
Sweden	Stockholm	24.7	4
Bulgaria	Sofia	24.3	5
Finland	Helsinki	23.4	6
Switzerland	Bern	22.5	7
France	Paris	21.4	8
Netherlands	Amsterdam	21.2	9
Iceland	Reykjavík	20.5	10
Germany	Berlin	20.4	11
Portugal	Lisbon	20.1	12
US - Delaware	Dover	18.9	13
US - North Dakota	Bismarck	18.4	14
Luxembourg	Luxemburg	18.3	15
US - Washington	Olympia	18.2	16
Slovakia	Bratislava	17.3	17
Singapore	Singapore	17.1	18
Denmark	Copenhagen	17.0	19
Hungary	Budapest	16.9	20
US - Maryland	Annapolis	16.3	21
Estonia	Tallinn	15.6	22
US - South Dakota	Pierre	15.6	23
Japan	Tokyo	15.5	24
US - Virginia	Richmond	15.0	25
US - Florida	Tallahassee	14.9	26
Norway	Oslo	14.8	27
Austria	Vienna	14.4	28
US - Wisconsin	Madison	14.3	29

Appendix Table 2a Continued
Average (Weighted) Download Speeds (2011): Non-US Capital Cities & US State Capitals and Washington D.C.

Country	City	Average (Weighted) Download Speed (Mbps)	Rank
US - Oregon	Salem	14.3	30
US - Minnesota	Saint Paul	14.2	31
US - Pennsylvania	Harrisburg	13.7	32
Belgium	Brussels	13.6	33
US - Rhode Island	Providence	13.6	34
US - New Jersey	Trenton	13.5	35
Czech Republic	Prague	13.4	36
US - New Hampshire	Concord	13.3	37
US - New York	Albany	13.1	38
US - Nevada	Carson City	13.1	39
US - Alabama	Montgomery	13.1	40
US - Arizona	Phoenix	12.4	41
US - Oklahoma	Oklahoma City	12.1	42
US - Illinois	Springfield	11.8	43
US - Texas	Austin	11.7	44
US - Utah	Salt Lake City	11.6	45
US - North Carolina	Raleigh	11.1	46
US - Louisiana	Baton Rouge	11.0	47
US - Missouri	Jefferson City	10.9	48
US - Colorado	Denver	10.8	49
US - Tennessee	Nashville	10.8	50
United Kingdom	London	10.7	51
Canada	Ottawa	10.6	52
US - Wyoming	Cheyenne	10.5	53
US - Kansas	Topeka	10.5	54
US - New Mexico	Santa Fe	10.1	55
US - Indiana	Indianapolis	9.9	56
Spain	Madrid	9.9	57
New Zealand	Wellington	9.7	58

Appendix Table 2a Continued
Average (Weighted) Download Speeds (2011): Non-US Capital Cities & US State Capitals and Washington D.C.

Country	City	Average (Weighted) Download Speed (Mbps)	Rank
US - Connecticut	Hartford	9.7	59
Poland	Warsaw	9.6	60
Ireland	Dublin	9.4	61
US - Ohio	Columbus	9.4	62
US - California	Sacramento	9.3	63
US - Massachusetts	Boston	9.3	64
Slovenia	Ljubljana	9.3	65
US - Michigan	Lansing	9.0	66
US - Arkansas	Little Rock	9.0	67
US - Mississippi	Jackson	8.9	68
US - D.C.	Washington DC	8.7	69
US - Idaho	Boise	8.7	70
US - Georgia	Atlanta	8.4	71
US - South Carolina	Columbia	8.1	72
US - Nebraska	Lincoln	8.1	73
US - Maine	Augusta	7.3	74
Chile	Santiago	7.0	75
US - Montana	Helena	6.8	76
US - Hawaii	Honolulu	6.7	77
US - Iowa	Des Moines	6.6	78
Turkey	Ankara	6.3	79
Greece	Athens	6.3	80
Australia	Canberra	6.1	81
US - West Virginia	Charleston	5.8	82
US - Vermont	Montpelier	5.8	83
Mexico	Mexico City	5.6	84
Israel	Jerusalem	5.4	85
Italy	Rome	5.2	86
US - Kentucky	Frankfort	3.7	87
US - Alaska	Juneau	3.0	88

Appendix Table 2b
Average (Weighted) Download Speeds (Mbps) (2011) of Two Cities within 100 miles of a Server for Non-US Countries

Country	City	Down Speed	Country	City	Down Speed
Australia	Caringbah	11.66	Italy	Sacile	3.59
Australia	Kingswood	10.10	Italy	Beinasco	4.41
Austria	Mattersburg	6.28	Japan	Ageo	24.89
Austria	Gmunden	10.20	Japan	Hachioji	22.78
Belgium	Hoogstraten	23.48	Korea	Suwon	34.94
Belgium	Temse	22.77	Korea	Yongin	35.34
Bulgaria	Gotse Delchev	20.22	Lithuania	Plunge	21.44
Bulgaria	Petric	22.20	Lithuania	Utena	33.79
Canada	Essex	2.73	Luxembourg	Betzdorf	6.35
Canada	Mont-Tremblant	6.45	Luxembourg	Itzig	12.43
Chile	Maipú	6.13	Mexico	Mexicali	3.07
Chile	Villa Alemana	6.67	Mexico	Chicoloapan	5.91
Czech Republic	Karviná	17.76	Netherlands	Zaltbommel	17.31
Czech Republic	Trebic	15.16	Netherlands	Oud-Beijerland	27.27
Denmark	Ballerup	21.79	New Zealand	Lower Hutt	8.52
Denmark	Viby	16.80	New Zealand	Whangarei	7.90
Estonia	Maardu	16.25	Norway	Jessheim	15.04
Estonia	Pärnu	8.32	Norway	Øvre Årdal	17.69
Finland	Karkkila	3.18	Poland	Lubon	8.00
Finland	Halikko	12.31	Poland	Szczecin	9.91
France	Conflans-Sainte-Ho	5.16	Portugal	Mafra	13.61
France	Torcy	16.22	Portugal	Cartaxo	9.64
Germany	Oberursel	18.13	Slovakia	Komárno	9.99
Germany	Neermoor	7.56	Slovakia	Nová Dubnica	12.47
Greece	Khalkís	5.10	Slovenia	Medvode	7.35
Greece	Iráklion	5.49	Slovenia	Novo Mesto	9.71
Hong Kong	Kowloon City	16.93	Spain	Cardedeu	5.83
Hong Kong	Lam Tin	39.57	Spain	Alcalá DeHenares	17.31
Hungary	Eger	18.84	Sweden	Trelleborg	13.68
Hungary	Farmos	8.75	Sweden	Hässelby	26.19
Iceland	Akranes	20.69	Switzerland	Lutry	26.77
Iceland	Keflavík	11.85	Switzerland	Winterthur	24.85
Ireland	Clare	3.38	Turkey	Maltepe	4.23
Ireland	Galway	8.05	Turkey	Sakarya	4.47
Israel	Qiryat Gat	7.36	UK	East Molesey	13.80
Israel	Qiryat Ono	7.19	UK	Strawberry Hill	11.09

Appendix Table 2c
Average (Weighted) Download Speeds (Mbps) (2011) of Two Cities within 100 miles of a Server for Each US State

State	City	Download Speed (Mbps)	State	City	Download Speed (Mbps)
Alabama	Piedmont	16.68	Louisiana	Gretna	12.37
Alabama	Rainsville	5.44	Louisiana	Marrero	21.68
Alaska	Anchorage	4.18	Maine	Rockland	9.10
Alaska	Kenai	1.69	Maine	Yarmouth	8.85
Arizona	Laveen	15.90	Maryland	Salisbury	13.27
Arizona	Peoria	14.89	Maryland	Walkersville	9.99
Arkansas	West Memphis	15.88	Massachusetts	Raynham	15.76
California	Hermosa Beach	18.26	Massachusetts	Scituate	17.02
California	Huntington Beach	14.58	Michigan	Dearborn	11.77
Colorado	Parker	15.80	Michigan	Grosse Pointe	14.37
Colorado	Windsor	13.30	Mississippi	Hernando	13.29
Connecticut	Fairfield	14.16	Mississippi	Horn Lake	15.94
Connecticut	Southington	9.97	Missouri	Ozark	8.36
Delaware	Milford	18.28	Missouri	Smithville	7.08
Delaware	New Castle	15.60	Montana	Billings	7.74
Florida	Homestead	14.84	Montana	Missoula	6.54
Florida	Orange Park	12.31	Nebraska	Norfolk	8.45
Georgia	Evans	13.97	Nebraska	Wayne	5.30
Georgia	Maysville	4.87	Nevada	Henderson	10.95
Hawaii	Kapolei	9.05	Nevada	Las Vegas	9.91
Hawaii	Kihei	7.76	New Hampshire	Londonderry	16.27
Idaho	Coeur D Alene	6.91	New Hampshire	Suncook	6.33
Idaho	Rathdrum	4.09	New Jersey	Bloomfield	11.59
Illinois	Burbank	14.54	New Jersey	Rockaway	15.97
Illinois	Watseka	8.25	New Mexico	Albuquerque	10.26
Indiana	Brazil	8.63	New Mexico	Placitas	11.54
Indiana	Demotte	9.12	New York	Bedford	18.96
Iowa	Le Mars	3.62	New York	Plainview	18.87
Iowa	Sioux Center	5.87	North Carolina	Arden	12.27
Kansas	Kansas City	6.58	North Carolina	Weaverville	11.69
Kansas	Overland Park	9.81	North Dakota	Grand Forks	20.47
Kentucky	Newport	10.77	Ohio	Oak Harbor	3.90
Kentucky	West Liberty	7.76	Ohio	West Milton	7.75

Appendix Table 2c Continued

State	City	Down Speed
Oklahoma	Collinsville	4.46
Oklahoma	Tulsa	10.42
Oregon	Eugene	13.11
Oregon	Hood River	5.02
Pennsylvania	Hollidaysburg	9.52
Pennsylvania	Whitehall	2.11
Rhode Island	East Providence	16.92
Rhode Island	Lincoln	15.60
South Carolina	Greenwood	4.86
South Carolina	Taylors	11.37
South Dakota	Vermillion	15.41
South Dakota	Yankton	17.90
Tennessee	Memphis	11.20
Tennessee	Smyrna	13.05
Texas	Corpus Christi	9.34
Texas	Princeton	2.68
Utah	Brigham City	11.82
Utah	Logan	14.71
Vermont	Colchester	10.48
Vermont	Manchester Center	10.84
Virginia	Oakton	18.04
Virginia	Spotsylvania	11.58
Washington	Washougal	13.08
Washington	Wenatchee	12.86
West Virginia	Chapmanville	3.56
West Virginia	Inwood	13.44
Wisconsin	Baraboo	17.77
Wisconsin	Sussex	11.92
Wyoming	Cody	8.97

Appendix Table 3a
Population Strata for Non-US Cities (2010-2011)
(Based on City Population and Ookla Data)

Strata	No. of Cities in Stratum	Proportion (%)
Very Small Cities Less than 25,000 inhabitants	7144	57.3
Small Cities Greater than or equal to 25,000, but less than 50,000 inhabitants	1721	13.8
Medium Cities Greater than or equal to 50,000, but less than 100,000 inhabitants	2742	22.0
Large Cities Greater than 100,000 inhabitants	851	6.8
Total	12, 458	

Appendix Table 3b
Population Strata for US Cities (2011)
(Based on City Population and Ookla data)

Strata	No. of Cities in Stratum	Proportion
Very Small Cities Less than 25,000 inhabitants	7303	30.4
Small Cities Greater than or equal to 25,000, but less than 50,000 inhabitants	8594	35.7
Medium Cities Greater than or equal to 50,000, but less than 100,000 inhabitants	5095	21.2
Large Cities Greater than 100,000 inhabitants	3072	12.8
Total	24, 064	

Table 3c
Average (Weighted) Download Speeds by Country (2011)
(Based on Stratified Sampling)

Country	Average Weighted Download Speed (Mbps)	Country	Average Weighted Download Speed (Mbps)
Korea	34.24	Norway	11.50
Hong Kong	31.26	Spain	11.35
Sweden	27.67	France	11.27
Lithuania	25.68	Canada	10.39
Netherlands	24.44	Finland	10.26
Switzerland	21.17	Hungary	10.08
Japan	20.25	Australia	9.68
Denmark	18.82	Austria	8.94
Bulgaria	18.76	United Kingdom	8.65
Singapore	17.12	Slovenia	8.37
Estonia	16.96	Poland	8.09
Belgium	16.59	Israel	6.55
Luxembourg	15.88	New Zealand	6.19
Iceland	14.66	Ireland	5.50
Portugal	14.63	Greece	5.34
Germany	14.21	Italy	4.78
Czech Republic	14.04	Chile	4.52
United States	12.53	Turkey	3.13
Slovakia	12.27	Mexico	2.88

Appendix Table 3d
Average (Weighted) Download Speeds by US States and International Countries (2011)
(Based on Stratified Sampling)

Country	Download Speed (Mbps)	Country	Download Speed (Mbps)	Country	Download Speed (Mbps)
Korea, Republic of	34.24	Oregon	13.52	Georgia	10.28
Hong Kong	31.26	Colorado	13.48	Finland	10.26
Sweden	27.67	Florida	13.16	Hungary	10.08
Lithuania	25.68	Tennessee	13.13	Australia	9.68
Netherlands	24.44	Indiana	12.84	Mississippi	9.49
Switzerland	21.17	Pennsylvania	12.82	Nevada	9.37
Japan	20.25	Illinois	12.71	Texas	9.26
Denmark	18.82	New Jersey	12.62	Maine	9.21
Bulgaria	18.76	Connecticut	12.51	Austria	8.94
Singapore	17.12	New Hampshire	12.36	New Mexico	8.91
Massachusetts	17.23	Kansas	12.36	United Kingdom	8.65
Estonia	16.96	Slovakia	12.27	Missouri	8.48
Delaware	16.84	Arizona	12.17	Kentucky	8.40
Belgium	16.59	Alabama	11.96	Slovenia	8.37
Rhode Island	16.31	Louisiana	11.61	Poland	8.09
Maryland	16.19	Norway	11.50	Montana	7.95
New York	15.89	Ohio	11.42	Hawaii	7.89
Luxembourg	15.88	Spain	11.35	Wyoming	7.50
South Dakota	15.73	California	11.29	Iowa	7.32
Virginia	14.86	France	11.27	Israel	6.55
North Dakota	14.77	Michigan	11.23	Idaho	6.53
Minnesota	14.68	Oklahoma	11.21	New Zealand	6.19
Iceland	14.66	Nebraska	11.14	Ireland	5.50
Portugal	14.63	North Carolina	11.10	Greece	5.34
Germany	14.21	Vermont	10.88	Italy	4.78
Utah	14.10	South Carolina	10.86	Chile	4.52
Czech Republic	14.04	Canada	10.39	Alaska	3.90
Wisconsin	13.87	Arkansas	10.37	Turkey	3.13
Washington	13.69	West Virginia	10.33	Mexico	2.88

Appendix Table 4a
Average Download Speeds (2011) in Very Small Cities for a Country/State
(Based on Stratified Sampling)

Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)
Hong Kong	31.0	Czech Republic	13.5	Australia	9.8
Korea, Republic of	30.5	Oregon	13.5	Georgia	9.8
Sweden	26.4	Kansas	13.5	Finland	9.8
Netherlands	24.8	Germany	13.4	Nevada	9.5
Lithuania	24.2	Florida	13.4	Arkansas	9.1
Switzerland	20.9	Alabama	13.0	California	8.9
Denmark	19.2	Washington	12.7	Iowa	8.9
Massachusetts	18.7	Indiana	12.7	Austria	8.7
Bulgaria	18.3	Oklahoma	12.4	Hawaii	8.6
Delaware	17.9	New Hampshire	12.3	Mississippi	8.5
Luxembourg	17.6	Tennessee	12.2	Hungary	8.5
Estonia	17.4	Louisiana	12.1	Kentucky	8.3
Japan	17.2	Spain	12.0	North Dakota	8.2
Maryland	16.7	South Carolina	11.9	Texas	8.2
Belgium	16.1	Connecticut	11.7	Slovenia	8.1
New York	16.0	Colorado	11.6	Missouri	8.1
South Dakota	15.8	North Carolina	11.6	Israel	6.5
Virginia	15.5	Michigan	11.5	Greece	6.0
Pennsylvania	15.3	Vermont	11.4	Wyoming	5.6
Iceland	14.6	Norway	11.2	Poland	5.5
New Jersey	14.5	Nebraska	11.1	New Zealand	5.3
Portugal	14.4	Slovakia	11.1	Chile	4.9
Minnesota	14.3	France	11.0	Ireland	4.8
Rhode Island	14.2	Ohio	11.0	Idaho	4.1
Wisconsin	13.8	Canada	10.4	Alaska	4.1
Illinois	13.8	Maine	10.3	Turkey	2.6
Utah	13.7	Montana	10.3	Mexico	2.2
Arizona	13.5	West Virginia	9.9		

Note: Very small cities are those with less than 25,000 inhabitants. These country/state average speed data are based on city samples drawn from Stratum 1 cities, according to the population proportions dictated by the stratified sampling approach. All countries/states may not be in this data if there are no cities in in the very small city category for that particular country/state in 2011.

Appendix Table 4b
Average Download Speeds (2011) in Small Cities for a Country/State
(Based on Stratified Sampling)

Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)
Lithuania	31.8	Utah	14.1	Alabama	10.3
Sweden	30.1	Czech Republic	13.9	South Carolina	10.2
Netherlands	24.2	Connecticut	13.7	Vermont	9.9
Belgium	23.9	Tennessee	13.7	Arizona	9.8
Switzerland	23.5	Indiana	13.7	Poland	9.8
Bulgaria	19.5	Oregon	13.0	Missouri	9.5
Rhode Island	18.6	New Jersey	13.0	Spain	9.4
Massachusetts	18.3	Michigan	12.4	Finland	9.0
North Dakota	18.1	New Hampshire	12.4	Oklahoma	8.8
Germany	17.0	Louisiana	12.3	Wyoming	8.8
Delaware	17.0	California	12.3	New Mexico	8.8
New York	16.2	Ohio	12.2	Iowa	8.4
South Dakota	15.8	Kansas	12.0	Kentucky	8.3
Maryland	15.5	Florida	12.0	Hawaii	7.2
Minnesota	15.4	Mississippi	11.3	France	6.8
Slovakia	15.2	Pennsylvania	11.2	Montana	6.2
Portugal	15.0	North Carolina	11.1	Idaho	6.0
Iceland	14.9	Arkansas	11.1	Maine	5.9
Virginia	14.9	West Virginia	10.9	Turkey	3.9
Washington	14.9	Illinois	10.8	Australia	3.6
Denmark	14.8	Georgia	10.5	Nevada	3.5
Colorado	14.7	Nebraska	10.3	Alaska	3.4
Hungary	14.5	Ireland	10.3	Mexico	3.4
Wisconsin	14.1	Texas	10.3	Chile	2.9

Note: Small cities are those with greater than 25,000, but less than 50,000 inhabitants. These country/state average speed data are based on city samples drawn from Stratum 3 cities, according to the population proportions dictated by the stratified sampling approach. All countries/states may not be in this data if there are no cities in the small city group for that particular country/state in 2011.

Appendix Table 4c
Average Download Speeds (2011) in Medium Cities for a Country/State
(Based on Stratified Sampling)

Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)
Hong Kong	36.1	New Hampshire	14.5	Arkansas	10.2
Sweden	33.4	Kansas	14.3	Nevada	10.2
Netherlands	30.0	Colorado	14.3	Texas	10.1
Switzerland	26.2	Minnesota	14.2	Georgia	9.9
Japan	21.9	Nebraska	13.9	Poland	9.7
Portugal	20.9	Washington	13.7	Missouri	9.7
Bulgaria	19.7	Indiana	13.5	Michigan	9.1
North Dakota	19.1	Czech Republic	13.2	South Carolina	8.8
Hungary	17.7	Illinois	13.2	Wyoming	8.7
Maryland	17.4	Spain	12.8	New Mexico	8.6
Rhode Island	17.1	Ohio	12.6	Idaho	8.6
New York	16.2	Arizona	12.4	United Kingdom	8.3
Germany	16.2	Connecticut	12.1	Mississippi	8.3
Slovakia	16.0	Alabama	11.9	Pennsylvania	8.3
Massachusetts	15.4	Virginia	11.8	Iowa	8.2
Utah	15.1	Finland	11.5	Montana	7.8
Oregon	15.1	North Carolina	11.3	France	7.1
Florida	14.8	California	10.7	Kentucky	7.0
Tennessee	14.7	New Jersey	10.7	New Zealand	6.4
Delaware	14.6	Louisiana	10.4	Italy	4.8
Wisconsin	14.6	Oklahoma	10.4	Turkey	3.3
South Dakota	14.6	Maine	10.2		

Note: Medium cities are those with greater than 50,000, but less than 75,000 inhabitants. These country/state average speed data are based on city samples drawn from Stratum 3 cities, according to the population proportions dictated by the stratified sampling approach. All countries/states may not be in this data if there are no cities in the medium city category for that particular country/state in 2011.

Appendix Table 4d
Average Download Speeds (2011) in Large Cities for a Country/State
(Based on Stratified Sampling)

Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)	Country\State	Download Speed (Mbps)
Korea, Republic of	36.0	Utah	13.3	North Dakota	10.5
Hong Kong	35.2	Finland	13.1	Kentucky	10.3
Sweden	31.8	Spain	12.7	New Mexico	10.3
Lithuania	25.6	Oregon	12.5	Wisconsin	10.2
France	21.9	South Carolina	12.4	Massachusetts	10.1
Hungary	21.7	Tennessee	12.4	North Carolina	10.0
Japan	20.8	Michigan	12.4	Alabama	10.0
Czech Republic	18.8	Nebraska	12.2	Louisiana	9.9
Poland	18.4	California	12.2	Kansas	9.9
Bulgaria	18.3	New Jersey	12.1	Ohio	9.2
South Dakota	16.7	Georgia	12.1	Canada	8.9
Virginia	16.3	Portugal	12.0	Texas	8.7
Minnesota	15.3	Oklahoma	11.9	Montana	7.7
Germany	15.1	Florida	11.8	Indiana	7.2
Denmark	14.9	Illinois	11.8	Iowa	6.7
Switzerland	14.5	Connecticut	11.5	Missouri	5.0
Norway	13.6	Pennsylvania	11.4	Chile	4.3
Washington	13.6	New York	10.9	Alaska	4.2
Colorado	13.6	Nevada	10.7		
Arizona	13.6	New Hampshire	10.7		

Note: Large cities are those with greater than 100,000 inhabitants. These country/state average speed data are based on city samples drawn from Stratum 4 cities, according to the population proportions dictated by the stratified sampling approach. All countries/states may not be in this data if there are no cities in the large city category for that particular country/state in 2011.

Appendix Table 5
Shortfall Index (%) (2010 and 2011

Country	2011	2010	Country	2011	2010
Slovakia	0.41	1.12	Turkey	14.88	
Israel	0.45		Netherlands	16.41	17.64
Lithuania	1.02	1.46	Spain	16.93	
Hungary	1.36	3.05	Singapore	17.16	
Poland	2.61		Sweden	17.76	22.04
Switzerland	3.23	3.87	Luxembourg	18.04	17.94
Slovenia	3.66		Belgium	18.16	19.17
Bulgaria	4.42	4.16	Germany	18.18	16.95
Chile	4.99		Portugal	19.21	21.13
Norway	5.06	6.07	Austria	22.27	18.57
United States	6.80	7.06	Ireland	24.03	
Estonia	6.96		New Zealand	28.80	
Czech Republic	6.98	6.95	Iceland	29.26	
Canada	11.72	11.94	Italy	31.80	
Denmark	11.73	12.02	United Kingdom	32.83	39.27
Mexico	13.78		Australia	37.88	37.40
Hong Kong	14.13		France	40.57	41.70
Finland	14.17	14.38	Greece	55.77	

Note: This measures the difference between the advertised and actual speeds based on the Promise Index data by Ookla

Appendix Table 6
Ookla and OECD Actual and Advertised Average Download Speeds, 2010 and 2011

Country	Ookla Actual	Ookla Advertised	OECD Advertised	Country	Ookla Actual	Ookla Advertised	OECD Advertised
Korea	36.0		55.59	Hong Kong	35.1	41.0	
Hong Kong	26.2			Korea	30.7		76.90
Japan	25.0		80.61	Lithuania	29.2	29.5	
Sweden	24.8	31.2	85.61	Sweden	27.9	33.4	102.76
Lithuania	22.3	22.5		Netherlands	23.6	28.0	50.19
Netherlands	21.4	26.1	39.59	Japan	22.5		156.18
Switzerland	17.4	18.1	20.78	Switzerland	21.0	21.7	22.84
Bulgaria	16.2	16.8		Bulgaria	19.2	20.1	
Iceland	14.6		27.05	Belgium	19.1	23.0	27.14
Germany	14.4	17.4	17.30	Denmark	18.8	21.2	36.97
Portugal	14.2	17.7	84.10	Singapore	17.3	21.0	
Belgium	13.1	16.1	24.89	Iceland	15.9	22.2	21.32
Czech Rep.	12.5	13.6	26.32	Czech Rep.	14.9	16.1	24.20
United States	11.3	12.2	14.67	Estonia	14.8	15.9	38.45
Finland	10.9	12.8	30.67	Slovakia	13.7	13.7	30.23
Slovakia	10.9	11.0	48.00	Portugal	13.7	16.8	83.36
Denmark	10.5	11.9	25.77	Germany	13.3	16.4	19.17
Hungary	10.1	10.4	20.09	Norway	12.2	12.8	72.07
France	9.9	17.1	66.84	United States	11.9	12.8	29.44
Australia	9.8	15.6	32.40	Hungary	11.6	11.6	27.10
Estonia	9.7		22.80	Luxembourg	11.3	14.3	21.30
Norway	9.1	9.7	46.14	Spain	10.9	13.2	26.74
Austria	9.0	10.6	29.16	Finland	10.7	12.4	44.21
Canada	8.5	9.6	20.82	Canada	10.1	11.5	45.92
Luxembourg	8.1	9.9	13.18	Australia	9.9	16.0	35.47
Poland	7.7		23.82	France	9.7	16.1	53.22
Spain	7.7		14.51	UK	8.8	12.5	35.27
UK	7.3	12.1	26.62	Austria	8.1	10.8	18.43
Slovenia	7.1		61.77	Slovenia	8.0	8.3	79.91
Singapore	6.4			New Zealand	7.8	10.7	23.39
Greece	6.3		16.09	Poland	7.4	7.6	23.60
New Zealand	5.9		22.02	Israel	7.0	7.0	15.87
Ireland	5.6		9.64	Ireland	6.4	8.4	26.33
Israel	5.1		15.87	Greece	5.3	12.0	10.57
Chile	4.5		8.87	Chile	5.2	5.4	12.37
Italy	4.3		29.98	Turkey	4.7	5.5	36.25
Turkey	3.8		17.30	Italy	4.5	6.6	22.68
Mexico	2.0		2.98	Mexico	2.9	3.4	5.15

Appendix Table 7a
Average (Weighted) Latency by Country (2011)

Country	Latency (milliseconds)	Country	Latency (milliseconds)
Korea	44.58	Germany	68.16
Bulgaria	44.92	Poland	68.21
Czech Republic	51.67	Chile	68.42
Slovakia	52.49	Ireland	68.60
Hungary	54.22	Greece	73.36
Lithuania	57.10	Australia	73.46
Portugal	60.12	United States	73.87
Belgium	60.35	Italy	74.17
Austria	60.93	Denmark	76.12
Hong Kong	61.16	Israel	78.50
Netherlands	64.54	Spain	81.89
Finland	65.81	Singapore	84.42
Turkey	66.13	Slovenia	84.95
Switzerland	67.34	France	91.04
New Zealand	67.44	Canada	92.94
Norway	67.55	Sweden	94.49
United Kingdom	68.13	Estonia	105.07
		Mexico	113.84

Note: Latency (round-trip latency) measures the amount of time it takes a data packet to travel from a source to a destination and back. It is measured as the sum of time from the start of packet transmission by a source to the start of packet reception by a destination plus the time that it takes for the packet to travel back from the receiving destination to the source, and is measured in milliseconds.

Appendix Table 7b
Average (Weighted) Latency by US States and International Countries (2011)

Country	Latency (milliseconds)	Country	Latency (milliseconds)
Rhode Island	43.28	Oregon	69.71
Bulgaria	43.49	Texas	69.78
Korea, Republic of	46.28	Kansas	69.98
Czech Republic	51.84	Missouri	70.13
Slovakia	53.51	Arizona	70.68
Oklahoma	55.07	New York	72.31
Hungary	55.39	Ohio	72.84
Arkansas	56.68	Australia	72.88
Lithuania	57.58	Italy	73.15
Kentucky	57.74	Greece	73.20
Belgium	58.98	Tennessee	73.79
Indiana	59.39	Denmark	75.41
Virginia	59.88	South Carolina	77.09
Colorado	60.33	Israel	78.66
Florida	60.54	Nevada	79.48
Portugal	60.70	District of Columbia	80.25
Austria	61.13	California	80.97
Alabama	61.23	North Carolina	81.11
Hong Kong	61.84	Spain	81.69
Finland	64.57	Idaho	82.29
Washington	64.65	Nebraska	82.81
Netherlands	65.14	Singapore	85.36
Turkey	65.33	Utah	88.23
Michigan	65.49	Slovenia	88.84
Switzerland	65.57	Pennsylvania	88.95
Wisconsin	65.65	France	90.58
Chile	66.42	Sweden	90.74
United Kingdom	66.75	Canada	91.91
Germany	66.89	Maryland	97.36
Norway	67.27	Estonia	104.05
Poland	67.46	Massachusetts	104.58
New Zealand	67.87	Mexico	111.70
Illinois	68.01	Connecticut	119.53
Minnesota	68.19	Iowa	130.05
Ireland	68.63	New Hampshire	137.05
Georgia	69.56	New Jersey	172.11

Appendix Table 8a
Average (Weighted) Jitter by Country (2011)

Country	Jitter (milliseconds)	Country	Jitter (milliseconds)
Korea	20.21	Netherlands	27.30
Greece	20.48	Lithuania	28.36
Bulgaria	20.62	Poland	28.89
Slovakia	21.63	United States	29.77
Austria	21.88	Finland	29.97
New Zealand	22.60	Australia	30.08
Belgium	22.86	Israel	30.18
Czech Republic	22.96	France	31.85
Italy	23.43	Sweden	33.17
Spain	23.62	Estonia	34.07
Hungary	24.79	Norway	34.20
Turkey	25.36	Switzerland	34.86
Ireland	25.88	Slovenia	35.08
Denmark	26.26	Chile	36.26
Germany	26.31	United Kingdom	39.02
Portugal	26.48	Singapore	39.42
Hong Kong	27.13	Canada	40.34
		Mexico	41.06

Note: Jitter refers to the variance of latency over time, and is measured by the average deviation from the mean latency of the network, and is measured in milliseconds.

Appendix Table 8b
Average (Weighted) Jitter by US States and International Countries (2011)

Country	Jitter (milliseconds)	Country	Jitter (milliseconds)
Iowa	16.43	Kansas	27.14
Arkansas	18.69	Ohio	27.23
Alabama	19.00	Netherlands	28.07
Oklahoma	19.10	Illinois	28.09
Bulgaria	19.63	Poland	28.39
Minnesota	20.13	Finland	28.94
Korea	20.18	Lithuania	29.01
Greece	20.36	Tennessee	29.42
Slovakia	20.96	Australia	29.66
Oregon	21.00	District of Columbia	29.88
Rhode Island	21.42	Virginia	30.05
Belgium	21.66	North Carolina	30.12
Austria	21.70	Israel	30.20
Indiana	21.79	Wisconsin	30.22
Colorado	22.01	Georgia	30.77
Italy	22.75	Nevada	30.85
Missouri	22.78	New York	31.33
Czech Republic	22.83	France	31.53
Utah	23.19	Sweden	31.87
New Zealand	23.30	Switzerland	33.76
Florida	23.44	Estonia	33.87
Spain	23.77	Pennsylvania	33.95
Turkey	24.50	Norway	34.02
Hungary	25.22	Chile	34.70
Nebraska	25.44	Slovenia	34.84
Arizona	25.46	California	35.30
Germany	25.57	Maryland	35.49
Ireland	25.65	United Kingdom	36.98
Idaho	25.82	Singapore	38.40
Kentucky	25.89	Canada	39.65
Texas	25.90	Mexico	40.06
Denmark	25.92	South Carolina	40.75
Michigan	26.19	Massachusetts	42.40
Washington	26.79	Connecticut	50.10
Hong Kong	26.84	New Jersey	74.40
Portugal	26.95	New Hampshire	114.52

Appendix Table 9a
Average (Weighted) Packet Loss by Country (2011)

Country	Packet Loss	Country	Packet Loss
Israel	1.08	Australia	3.26
Estonia	1.12	Germany	3.32
Hong Kong	1.21	United States	3.40
Korea	1.26	Czech Republic	3.46
Slovenia	1.28	United Kingdom	3.60
Lithuania	1.33	Bulgaria	3.62
Switzerland	1.38	Poland	3.64
Sweden	1.71	Portugal	3.67
Canada	1.80	New Zealand	3.91
Slovakia	1.82	Belgium	3.96
Chile	1.90	Spain	4.00
Denmark	1.97	Ireland	4.54
Netherlands	2.39	Hungary	4.84
Norway	2.44	Austria	5.01
Italy	2.63	Mexico	5.17
France	2.91	Turkey	6.15
Singapore	3.08	Finland	7.94
		Greece	10.01

Note: When packets of data travelling across the network fail to reach their destination, the phenomenon is termed packet loss. Packet loss can occur because of network congestion, signal degradation, faulty network drivers or networking hardware, and the distance between the origin of the transmitted data and the destination. When packet loss occurs due to these reasons, it can be used as a quality loss metric.

Appendix Table 9b
Average (Weighted) Packet Loss by US States and International Countries (2011)

Country	Packet Loss	Country	Packet Loss
Connecticut	0.53	Maryland	2.90
Israel	1.03	France	2.90
New Jersey	1.07	Indiana	2.97
Estonia	1.12	Minnesota	2.99
Korea, Republic of	1.21	Colorado	3.00
Slovenia	1.21	Nevada	3.05
Hong Kong	1.24	New York	3.09
Lithuania	1.38	Singapore	3.14
Switzerland	1.40	Germany	3.21
Canada	1.77	Wisconsin	3.21
Nebraska	1.80	Florida	3.21
Sweden	1.81	Bulgaria	3.24
Slovakia	1.83	Australia	3.26
Iowa	1.89	United Kingdom	3.27
Rhode Island	1.90	Ohio	3.28
Chile	1.91	Massachusetts	3.29
Denmark	2.01	California	3.34
Utah	2.03	Czech Republic	3.53
Oklahoma	2.03	Poland	3.54
Arkansas	2.07	Portugal	3.55
Oregon	2.08	Georgia	3.62
District of Columbia	2.16	New Zealand	3.76
New Hampshire	2.18	Ireland	4.02
South Carolina	2.34	Idaho	4.02
Netherlands	2.39	Spain	4.07
Pennsylvania	2.39	Belgium	4.20
Norway	2.55	Texas	4.39
Washington	2.55	Hungary	4.59
Italy	2.55	Austria	4.95
Kansas	2.63	Mexico	4.95
Michigan	2.65	Missouri	5.08
Illinois	2.65	North Carolina	5.66
Tennessee	2.71	Turkey	5.97
Arizona	2.79	Alabama	6.89
Kentucky	2.82	Finland	7.92
Virginia	2.90	Greece	9.63